THE ROLE OF INTELLECTUAL PROPERTY IN AGRICULTURAL PUBLIC-PRIVATE PARTNERSHIPS IN THE CONTEXT OF DEVELOPMENT

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Declaration

I hereby declare that this thesis is my own work and that it has not been submitted for a degree at any other university.

Abstract

Food insecurity is an important global problem severely affecting developing countries, particularly those in Asia and Africa. Agricultural research in developing countries is characterised by the following tension: the private sector has plenty of applied research skills and experience but these are primarily used for commercial gain; the public sector has excellent research but the research is often not applied. Agricultural public private partnerships are currently acclaimed as a means of redressing this tension through optimising the complementary synergies between the two sectors in order to address food security.

Private sector involvement in agriculture, including public private partnerships (PPPs) has increased in the past two decades as has the use of intellectual property rights (IPRs) in agriculture research. The two sectors have differing and sometimes conflicting perspectives on IP as a concept and in the strategies used to manage intellectual property. IPRs have the potential to enhance or hinder the achievement of a partnership's objectives.

This thesis investigates whether, to what extent and in what ways IP is relevant to food security oriented PPPs. It uses two case studies in India and Kenya involving two centres in the Consultative Group on International Agriculture Research (CGIAR) to locate the role that IP plays in the formation and execution of food security oriented PPPs in the context of development. It argues for a bespoke analysis of PPPs as the preferred means through which the impact and effect of factors such as IPRs can be meaningfully examined. It finds that the relevance of IP to food security oriented PPPs in developing countries is determined by two factors: the nature of the technology used in the partnership and the stage of the partnership.

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List of acronyms and abbreviations

AFSTA	The African Seed Trade Association
ASTI	Agricultural Science and Technology Indicators
BCIL	Biotech Consortium India Limited
Bt.	Bacillus thuringiensis
BTA	Biotechnology Trust Africa
CBD	Convention on Biological Diversity
CG	Same as CGIAR
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center for Tropical Agriculture
CIFOR	Center for International Forestry Research
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CSIR	Council for Scientific and Industrial Research (India)
CSO	Civil society organization
DAC	Development Assistance Committee (of the OECD)
DBT	Department of Biotechnology (India)
DfID	Department for International Development (UK)
DSIR	Department of Scientific and Industrial Research (India)
DUS	Distinct, uniform, stable
ECF	East coast fever
FAO	Food and Agriculture Organization (of the United Nations)
FDI	Foreign direct investment
FTO	Freedom to operate
GDP	Gross Domestic Product
GURTs	Genetic Use Restriction Technologies
IARC	International Agricultural Research Center
ICAR	Indian Centre for Agricultural Research
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRAF	World Agroforestry Centre
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFPRI	International Food Policy Research Institute

IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
IP	Intellectual property
IPRs	Intellectual property rights
IRD	Integrated rural development
IRRI	International Rice Research Institute
ISAAA	International Service for the Acquisition of Agri-biotech Applications
IT PGRFA	International Treaty for Plant Genetic Resources for Food and Agriculture
IWMI	International Water Management Institute
KARI	Kenyan Agricultural Research Institute
KEFRI	Kenya Forestry Research Institute
KEMFRI	Kenya Marine and Fisheries Research Institute
KEMRI	Kenya Medical Research Institute
KEPHIS	Kenyan Plant Health Inspectorate Service
KETRI	Kenya Trypanosomiasis Research Institute
KIPI	Kenyan Intellectual Property Institute
KIRDI	Kenya Industrial Research and Development Institute
KTDA	Kenya Tea Development Agency
LICR	The Ludwig Institute of Cancer Research (Belgium)
MDG	Millennium Development Goals (of the UN)
MNC	Multinational corporations
MTA	Material transfer agreement
MTM	Mid-term meeting (of the CGIAR)
NARI	National agricultural research institute (in a developing country)
NARS	National Agricultural Research System
NCPB	National Cereals and Produce Board (Kenya)
NCST	National Council for Science and Technology (Kenya)
NDUS	New distinct uniform and stable
NGO	Non-governmental organization
NGOC	Non-Governmental Committee (of the CGIAR)
OECD	The Organisation for Economic Cooperation and Development
OPV	Open pollinated variety (as opposed to hybrid)
PBR	Plant breeder’s rights
PCT	Patent Cooperation Treaty

PPP	Public–private partnership
PS	Private sector
PSC	Private Sector Committee (of the CGIAR)
PVP	Plant variety protection
R&D	Research and Development
SAP	Structural adjustment programme
T. *parva.*	*Theileria parva*
TIFAC	Technology Information Forecasting and Assessment Council (India)
TIGR	The Institute for Genomic Research (now J. Craig Venter Institute)
TRIPS	(agreement on) Trade Related Aspects of Intellectual Property Rights
UCG	University Grants Commission (India)
UPOV	International Union for the Protection of New Varieties of Plants
WARDA	Africa Rice Centre
WB	the World Bank
WIPO	World Intellectual Property Organization
WTO	World Trade Organization

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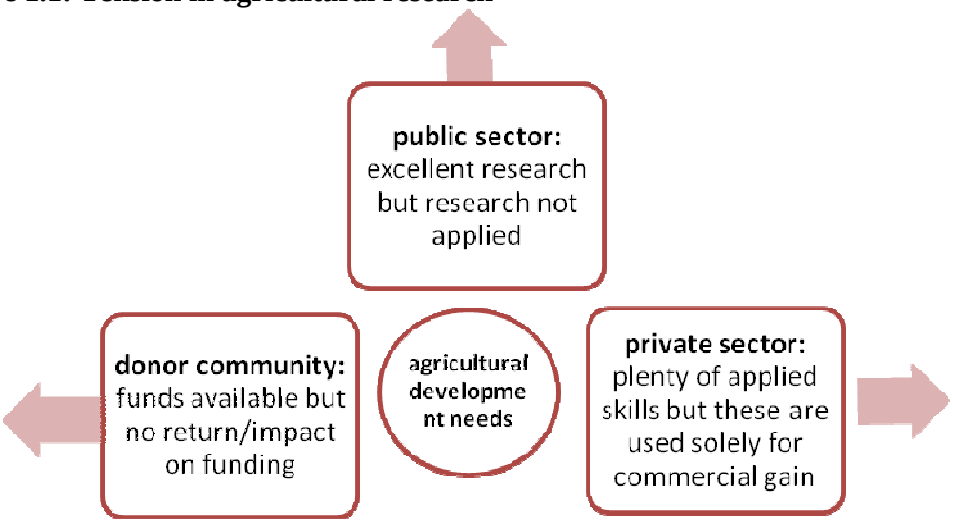
Chapter One

Introduction and overview

1.0 The problem

Agricultural development needs, including the attainment of food security are characterised by the following tension: the public sector has excellent research but the research is often not applied; the private sector has plenty of applied research skills and experience but these are primarily used for commercial gain. In developing countries, funding is available from donors although recipients are increasingly required to demonstrate impact.

Figure 1.1: Tension in agricultural research



While most agricultural research in developing countries continues to be done by the public sector, recent years have seen a growth in private sector engagement. The number of private companies involved in agriculture and related activities and the amount of investment from the private sector has increased in the last two decades.[1]

[1] Pray, C. & Fuglie, K., 'The private sector and international technology transfer in agriculture' in Fuglie, K. & Schimmelpfennig, D. (eds.) *Public-Private collaboration in agricultural research* (Ames: Iowa State University

The increasing private sector presence and privatisation of knowledge in agriculture potentially reinforces the tension between public and private agricultural research in ways that may undermine food security. Public private partnerships (PPPs) are hailed as important institutional strategies to address this tension. PPPs have immense potential to contribute to the attainment of food security. There is increasing evidence suggesting that PPPs are growing in popularity in development policy and practice as a means of addressing global issues as diverse as agriculture, health and finance.[2]

PPPs take many forms some of which include private distribution of public goods, private purchase of public technology or services, and public private collaborative research.[3] Some of these collaborations may involve proprietary technology. Successful pro-poor agricultural PPPs are constrained by different incentives structures[4] of which intellectual property (IP) is a subset.

With the increasing privatisation of knowledge in agriculture research, there are indications that intellectual property rights (IPRs) are increasingly in use in food security oriented PPPs.[5] Indeed, research tools and products used in agricultural research are now more likely than ever to be protected by IPRs, which has now become a major concern.[6]

On the one hand, IP can play a beneficial role in PPPs with food security objectives as it enhances a partnership's ability to achieve its pro poor food security goals. On the other hand, such rights can also reinforce the conflict of interest between the public and private sector parties. As a concept, IPRs are structured towards the attainment of private rights. This

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Press, 2000); Beintema, M. & Stads, G., 'Agricultural R&D in sub-Saharan Africa: an era of stagnation' ASTI background report (Washington DC: International Food Policy Research Institute, 2006)

[2] For example, Buse, K. & Walt, G., Global public-private partnerships: part II- What are the health issues for global governance? *Bulletin of the World Health Organisation* 78/5 (2000) 699

[3] Hall, A., Sulaiman, R., Clark, N., Sivamohan, M. & Yoganand, B., 'Public-private sector interaction in the Indian agricultural research system: an innovation systems perspective on institutional reform' in Byerlee, D. & Echeverría, R., (eds.) *Agricultural research policy in an era of privatization* (Oxon: CABI Publishing, 2002)

[4] Spielman, D. & Grebmer K., Public-private partnerships in international agricultural research: an analysis of constraints, *Journal of Technology Transfer* 31/2 (2006) 291

[5] Spielman, D., Hartwich, F. & Grebmer, K., 'Sharing science, building bridges, and enhancing impact' IFPRI Discussion Paper 00708 (2007)

[6] Reifschneider, F., Mobilising resources for agricultural innovation public and private partnerships: an invitation to a dialogue, paper presented at 'The International Workshop on Transforming Tropical Agriculture: An Assessment of Major Technological, Institutional and Policy Innovations' Brasilia, 17-19 July (2006); von Braun, J. & Ferroni, M., Public-private partnerships in agricultural research: Towards best practice and replicable models, presented at the conference 'Scaling up public-private partnerships in agricultural research to benefit the poor' The World Bank, 30 October (2008)

is more consonant with the private sector than with the public sector.[7] There are concerns about the application and management of IPRs by the public sector in the provision of public goods[8] and particularly in food security oriented research.

1.1 Hypothesis and main research question

Food security oriented PPPs increasingly involve the use of privatised knowledge. The public and private sectors approach IP from different ideologies, perspectives, practices and capacities. These differences have the potential to enhance or hinder a PPP's food security goals. This thesis hypothesises that *intellectual property (IP) is relevant to food security oriented public private partnerships (PPPs) in developing countries and that it affects their formation and execution.* The main research question is *whether, to what extent and in what ways is IP relevant to food security oriented PPPs in developing countries?*

1.2 Conceptual framework

This research finds its theoretical basis on the apparent gap between the concepts of IP and PPPs.[9] The theory,[10] origin and development,[11] and the economic,[12] legal and philosophical[13]

[7] Mugabe, J., 'Intellectual property protection and traditional knowledge: an exploration of international policy discourse' a paper prepared for WIPO (1998) available at http://www.acts.or.ke/paper%20-%20intellectual%20property.htm

[8] Maredia, K. Application of intellectual property rights in developing countries: implications for public policy and agricultural research institutes (Geneva: WIPO, 2001); Atkinson, R. *et al.* Intellectual property rights: Public sector collaboration for agricultural IP management *Science* 301/5630 (2003) 174; Cohen, J., 'Managing intellectual property: Challenges and responses for agricultural research institutes' in Persley, G. & Latin, M., (eds.) *Agricultural Biotechnology and the Poor: Proceedings of an International Conference 21-22 October 1999* (Washington DC: CGIAR, 2000) and also Mahoney, R. & Krattiger, A., 'The role of IP management in health and agricultural innovation' in Krattiger, A. *et al.,* (eds.) *Intellectual property management in health and agricultural innovation: a handbook of best practices* (Oxford: MIHR & Davis: PIPRA, 2007)

[9] The references in this section are not meant to be exhaustive but rather serve to demonstrate that this area of IP is well researched and documented.

[10] Moore, A., A Lockean theory of intellectual property, *Hamline L. Rev.* 21/65 (1997); MacCormick, N., On the very idea of intellectual property: an essay according to the institutionalist theory of law, *IP Quarterly* 3 (2002) 227; Sell, S., *Power and ideas: north-south politics of intellectual property and antitrust* (Albany: State University Press of New York, 1998)

[11] Bouckaert, B., What is property? *Harv. J. L.& Pub. Pol'y* 13 (1990) 775; May, C. & Sell, S., *Intellectual property rights: a critical history* (London: Lynne Rienner Publishers, 2006)

[12] Besen, S. & Raskind, L., An introduction to the law and economics of intellectual property, *Journal of economic perspectives* 5/1 (1991) 3; David, P., 'Intellectual Property institutions and the panda's thumb: patents, copyrights, and trade secrets in economic theory and history' in Wallerstein, M., Mogee, M. & Schoen, R., (eds.) *Global dimensions of intellectual property rights in science and technology* (Washington DC: National Academy Press, 1993); Primo Braga, C., Fink, C. & Sepulveda, C., 'Intellectual property rights and economic development' World Bank Discussion Paper No. 412 (Washington DC: World Bank, 2000); Maskus, K., *Intellectual property rights in the global economy* (Washington DC: Institute for International Economics, 2000); Sherwood, R., *Intellectual property and economic development* (Oxford: Westview Press, 1990)

justifications of IP is well documented. IP within the context of the global political economy is also widely debated and researched.[14] Similarly, a substantial amount of literature mainly drawn from innovation theory elucidates the theory,[15] rationale,[16] constraints[17] and various models[18] of PPPs. Although concepts of IP and PPPs have sympathy, they have hitherto assumed separateness on a conceptual level. The thesis addresses this theoretical separateness and tests it against the empirical case studies. This thesis stands on three pillars: IP, PPPs and agriculture in the context of food security in developing countries.

1.2.1 Increasing privatisation in agricultural research

The environment in which food security oriented agricultural research is conducted has changed over the past four decades. The public sector's focus changed from cash crops in the

[13] Palmer, T., Intellectual property: a non-Posnerian law and economics approach, *Hamline L. Rev.* 12/2 (1989) 261; Correa, C., I*ntellectual property rights, the WTO and developing countries* (London: Zed Books & Third World Network, 2000); Boyle, J., *Shamans, software, and spleens: law and construction of the information society* (Massachusetts: Harvard University Press, 1996); Drahos, P., *A philosophy of intellectual property* (Aldershot: Dartmouth Publishing Company, 1996); Merges, P., Menell, P. & Lemley, M., (eds.) *Intellectual property in the new technological age* (New York: Aspen Publishers, 2003); Palmer, T., Are patents and copyrights morally justified? The philosophy of property rights and ideal objects, *Harvard Journal of Law & Public Policy* 13/3 (1990) 817; Nance, D., Owning ideas, *Harv. J. L.& Pub. Pol'y* 13 (1990) 757; May, C., *A global political economy of intellectual property rights: the new enclosures*? (London & New York: Routledge, 2000);

[14] Dutfield, G. 'Intellectual property in the global economy: high stakes and propaganda warfare' in Dutfield, G., (ed.) *Intellectual property rights and the life science industries: a 20th century history* (Aldershot: Ashgate Publishing Limited, 2003); Richards, D., *Intellectual property rights and global capitalism: the political economy of the TRIPs Agreement* (New York: M. E. Sharpe, 2004); Matthews, D., *Globalising intellectual property rights: the TRIPs Agreement* (London: Routledge, 2002)

[15] O'Neil, D., Performance measurement in public-private partnerships: learning from praxis, constructing a conceptual model, paper presented at the 'American Society for Public Administration 65th National Conference' Portland, 27-30 March (2004); Besley, T. & Ghatak, M., Public-private partnerships for the provision of public goods: theory and an application to NGOs, paper presented for the Development Economics Discussion Paper Series, London School of Economics (1999); Pongsiri, N., 'Regulation and public private partnerships' Centre on Regulation and Competition working paper series, Paper no. 12 (2001); Osbourne, S., *Public-private partnerships: theory and practice in international perspective* (New York: Routledge Press, 2000)

[16] Fiszbein, A. & Lowden, P., *Working together for a change: government, civic and business partnerships for poverty reduction in Latin America and the Caribbean* (Washington DC: Economic Development Institute of the World Bank, 1999); James, C., Agricultural research and development: the need for public-private sector partnerships, *Issues in Agriculture* 9 (1996)

[17] Spielman, D., Agricultural sector investment and the role of public-private partnerships, paper presented at 'The African development and poverty reduction: the macro-micro linkage forum' South Africa, 13-15 October (2004a); Spielman & Grebmer (2006) *supra* note 4; Spielman, D. & Grebmer, K. 'Public-private partnerships in international agricultural research: an analysis of challenges facing industry and the Consultative Group on International Agricultural Research' EPTD Discussion Paper 113 (Washington DC: IFPRI, 2004b)

[18] Pray, C., Public-private sector linkages in research and development: biotechnology and the seed industry in Brazil, China and India, *Amer. J. Agr. Econ.* 83/3 (2001); also Hall *et al*. (2002) *supra* note 3 to name a few

1970s to food crops in the 1980s following the food crisis.[19] The public sector's research agenda has since diversified as a result of factors such as declining public funds and the need to demonstrate more impact. Agricultural public research institutes in developing countries are mostly commodity oriented and have adopted a supply driven research agenda although there are indications that some may be engaging in demand led research.

Traditionally, agricultural R&D was within the public sector ambit and was usually conducted under a government department with funding from the central, federal or state government. Although agricultural research in developing countries is still predominantly public sector-led, the agricultural scene is increasingly characterised by private sector presence. [20] This can be attributed to a number of factors. The budgetary austerity period of the 1980s and the incident privatisation of public research entities was a major catalyst in promoting the increase of private sector actors in agricultural research.

Since then, certain factors have acted to promote private sector interest in the agricultural sector. It has been argued that private sector investment in the agricultural sector crucially depends on the protection of IP and that appropriation of benefits through IPRs, including trade secrets, are a main deciding factor on private sector investment in agriculture.[21] The potential appropriation of benefits from agricultural research offered by IPRs may have helped increase private sector engagement in agriculture. Manicad lists other deciding factors such as the availability of the public sector to provide knowledge and competent human resources to the private sector.[22] A large actual or potential market, for example India, has also been cited as a consideration for private investment in agriculture.[23] The general business

[19] For an account on how the public sector has evolved, see Byerlee, D., Alex, G. & Echeverria, G., 'The evolution of public research systems in developing countries: Facing new challenges' in Byerlee, D. & Echeverría, R., (eds.) *Agricultural Research Policy in an Era of Privatization* (Oxon: CABI Publishing, 2002)

[20] Pardey, P. & Beintema, N., 'Slow magic: agricultural R&D a century after Mendel' IFPRI Food Policy Statement (Washington DC: IFPRI, 2001); see also Beintema, N. & Stads, G., 'Investing in sub-Saharan African agricultural research: Recent trends' 2020 Africa Conference Brief 8 (Washington DC: IFPRI, 2004); and Hall *et al*. (2002) *supra* note 3; Huffman, W., Public-private research and development relationships: discussion, *Amer. J. Agr. Econ.* 83/3 (2001) shows that in the US, the private sector is the main source of funds for agriculture R&D and its share is growing

[21] Lele, U., Lesser, W. & Horstkotte-Wesseler, G. (eds.) *Intellectual property rights in agriculture, the World Bank's role in assisting borrower and member countries* (Washington DC: World Bank, 2000)

[22] Manicad, G., CGIAR and the private sector: Public good versus proprietary technology in agricultural research, *Biotechnology and Development Monitor* 37 (1999) 8

[23] Binenbaum, E., Pardey, P. and Wright, B. Public-private research relationships: The Consultative Group on International Agricultural Research *Amer. J. Agr. Econ.* 83/3 (2001) 748

climate in a country is likewise a major consideration. Pray[24] summarises the conditions for growth in private research in developing countries as liberalisation of polices and regulation on input industries, strong IPRs, rapid growth in markets for agricultural inputs and public research to keep private research costs down.

It is critical that food security oriented agricultural research is driven by the public sector especially in vulnerable agricultural economies not in the least because of the dangers posed by private sector-driven research agendas. Given the private sectors' ultimate objective of profit acquisition, private sector-driven research may distort research priorities, such as when private companies choose to invest in commercial crops and neglect subsistence crops including 'pro-poor orphan crops' i.e. food crops grown by the poor for their subsistence. Growing literature on private sector investment in developing countries shows that private firms typically invest in agriculture R&D for those crops, traits and technologies that benefit farming systems that are organised along lines similar to those in developed countries.[25]

Chapter two examines the evidence of increasing private sector engagement in Kenya and India and attempts to locate the role of IPRs in private sector investment in agriculture in the context of development. It looks at the potential impact of the changing agricultural research scene in developing countries on efforts aimed at the attainment of food security.

1.2.2 Increasing use of IPRs in food security agricultural research

The traditional classification of goods as being either public or private is based largely on neo-classical economics.[26] This posits that there is a natural division of labour between the public sector which mainly is responsible for the provision of public goods, and the private sector, which mostly engages in the provision of private goods. In addition, a good is classified as either public or private based on two main factors: excludability and rivalry. Goods or services are said to be non-excludable if non payers cannot be excluded from the benefits of the good or service. Non-rivalrous goods and services are those whose marginal cost of an additional person consuming them, once they have been produced, is zero. Pure

[24] Pray, C., 'The growing role of the private sector in agricultural research' in Byerlee, D. & Echeverría, R., (eds.) *Agricultural research policy in an era of privatization* (Oxon: CABI Publishing, 2002)
[25] Spielman (2004b) *supra* note 17
[26] Granstrand, O., (ed.) *Economics, law and intellectual property: seeking strategies for research and teaching in a developing field* (London: Kluwer Academic Publishers, 2003)

public goods are said to be non-rivalrous and non-excludable while private goods have high excludability and high rivalry. Hybrid or mixed goods are located along the public goods – private goods continuum; these contain elements of excludability and rivalry.

There is an abundance of literature on IPRs as an economic concept[27] whose rationale is to enable the inventor to recoup costs and to encourage and reward invention by granting the inventor a monopoly over his creation for a stipulated period. This rationale reinforces the argument that IP is modelled on private gains and is therefore more compatible with private sector research. The application of IPRs introduces excludability to goods in the classical distinction between private goods and public goods on the basis of Samuelson's[28] rivalry and Musgrave's[29] excludability criteria. This excludability renders the goods so protected to move from the realm of free availability to that of exclusivity. The central postulation of public sector mandate is the provision of goods that are equally available and accessible to all. In theory therefore, there is an inherent conflict in the use of intellectual property rights in the provision of public goods. Chapter three critically examines this theoretical conflict in the context of the Consultative Group of International Agricultural Research (CGIAR or CG). The Centres in the CG conduct food security oriented agricultural research for the benefit of the poor in developing countries. The CG's primary mandate is the provision of global public goods.

This theoretical conflict is the basis of the concern over the use of IPRs by public research institutions with food security and other social welfare goals. Public research institutions including the CG Centres are increasingly exposed to working with the private sector. There have been fears that by collaborating with the private sector, a public research organisation may be impeded from fulfilling its mandate to deliver public goods.[30]

On the other hand, there have been arguments by the public sector that, in some cases, collaboration with the private sector is in fact vital to fulfilling its mandate. This is usually in

[27] For example Granstrand, O., *The economics and management of intellectual property: towards intellectual capitalism* (Cheltenham: Edward Elgar, 1999)
[28] Samuelson, P., The pure theory of public expenditure, *The Review of Economics and Statistics*, 36/4 (1954) 387
[29] Musgrave, R., *The theory of public finance* (New York: McGraw-Hill, 1959).
[30] This has been expressed in numerous publications on the challenges the public sector face in PPPs. See Manicad (1999) *supra* note 22; on the role of IP in public research, see Fischer, K. & Byerlee, D., 'Managing intellectual property and income generation in public research organisations' in Byerlee, D. & Echeverría, R., (eds.) *Agricultural research policy in an era of privatization* (Oxon: CABI Publishing, 2002)

the distribution of hybrid seed. Seed companies have comparative advantage in the deployment of such technologies and collaboration with them is considered crucial by sections of the public sector.[31] In some cases, seed companies have been unwilling to deploy technologies developed by the public sector without assurance that such arrangements are exclusive to the partnership.

In developed countries, IP management is now a major focus in public research institutions especially those that are in PPPs or are involved in developing technologies that have some proprietary value.[32] Lack of public sector capacity in IP has been cited as a setback in effective PPPs in developing countries.[33]

Chapters three and four distinguish between the *existence* of IPRs and the *exercise* of IPRs and argue that it is the latter rather than the former that determines the effect IPRs have on the achievement of food security related objectives in public research institutions and in PPPs. Capacity in IP is vital in the *exercise* of IPRs to balance competing interests in PPPs, and especially in relation to the public good mandates within the CG Centres. In particular, chapter four looks at ways in which CG Centres can use IPRs without compromising their food security public goods mandates.

1.2.3 PPPs in food security agricultural research

Partnerships are not new to the field of agriculture; traditionally, public agriculture research institutes conducted research in partnership with farmers mainly through agriculture research extension programs. PPPs in agriculture, particularly in plant breeding and in biotechnology, are currently critically acclaimed. Research economists, policy makers and scholars increasingly highlight the food security related benefits to be gained by collaboration between

[31] Tripp, R., *New seed and old laws: regulatory reform and the diversification of national seed systems* (London: ODI, 1997)

[32] In the US, many universities and Public Research Organisations have established technology transfer offices (TTOs). See Graff G., Roland-Holst, D. & Zilberman, D., Agricultural biotechnology and globalisation: the role of public and private sector research, paper presented at the 'Workshop on Environmental Costs and Benefits of Transgenic Crops in Europe' 2-4 June (2003). Universities in developing countries are catching on; in Kenya, all the main public universities have or are in the process of formulating IP policies virtually all of which address technology transfer through some form of IP office (pers. comm.)

[33] Kameri-Mbote, P., Wafula, D. & Clark, N., *Public private partnerships for biotechnology in Africa* (Nairobi: ACTS Press, 2001)

the public and private sectors.[34] This is mainly borne out of the recognition of the synergy existing between the public and private sectors.

The term PPPs is amorphous and invites a myriad of interpretations. Various academics, scholars, policy makers and practitioners have adopted diverse definitions. In its report, the Commission on PPPs termed 'public', 'private' and 'partnership' as 'three of the most slippery terms in the modern political dictionary. Putting them together is almost an invitation to muddled thinking and confusion.'[35]

Very generally, most attempts at defining PPPs can be classified into two groups: those that attempt to define PPPs by what they do and those that define PPPs by a deconstruction of the constituent terms. Most definitions seem to fall within the former perhaps demonstrating the inadequacy and ambiguity of the welter of meanings invited by the individual terms which render inadequate the latter method of definition.

Adopting Brinkerhoff's[36] perspective of PPPs as lying along a continuum of relationship types, in this work PPPs will be used in a broad sense encompassing relationships between the public sector and both the private and voluntary and charitable sectors. This work includes institutional relationships which are a little more than contractual relationships and does not go as far as those definitions which demand a relationship 'over and above' contractual relations. This deliberate attempt aims at including simple technology transfer relationships which dominate a significant number of interactions between the public and private sectors in pro-poor agricultural R&D.

The welter of meanings of the term 'PPPs' is indicative of differing theories and perspectives that influence the definitions. Partly because of the amorphous way in which partnerships are defined, there is little agreement about how best to analyse such arrangements. There are

[34] Hall, A., Sivamohan, M., Clark, N., Taylor, S. & Bockett, G., Institutional developments in Indian agricultural R&D systems: emerging patterns of public and private sector activity, *Science, technology and development* 16/3 (1998); Hall, A., Sivamohan, M., Clark, N., Taylor, S. & Bockett, G., Why research partnerships really matter: innovation theory, institutional arrangements and implications for developing new technology for the poor, *World Development* 29/5 (2001); Spielman & Grebmer (2006) *supra* note 4; Kameri-Mbote *et al*. (2001) *supra* note 33

[35] Commission on Public Private Partnerships, *Building better partnerships* (London: IPPR, 2001) at p38

[36] Brinkerhoff, D. & Brinkerhoff, M. Partnerships between international donors and non-governmental development organisations: opportunities and constraints, *International Review of Administrative Sciences* 70/2 (2004) 253

numerous competing as well as complementary theoretical perspectives that assist (or do not) in understanding the motives, nature and effects of partnerships. There is no one rationale for PPPs; institutions and organisations have many reasons for adopting a partnership approach to the delivery of public goods or services. From the existing literature, six rationales for PPPs can be identified.

Table 1.1: Rationales for PPPs

Economic rationale	PPPs as a response to market failure – based on traditional division of labour between the public and private sector
Wider participation	PPPs constitute a 'Third Way' between 'privatisers' and 'monopolists'
Complexity of modern problems	PPPs provide multi-actor integrated solutions required by the wide scope and complex nature of today's problems
Synergy and complementarity	PPPs achieve more than the individual agents can independently
Accessing new resources & skills	PPPs are an important tool for acquisition of new resources including information, technical and management skills
Saving costs	PPPs increase the financial base of the parties

PPPs in the agricultural scene take different forms and may be formal or informal. Although there is no blueprint for PPPs, certain pre-existing conditions are presumed to exist, one of which is that parties have mutual interest in achieving a named goal. It is presumed that they have overlapping complementary interests[37] as well as sufficient capacity. The collaboration or partnership invariably involves a search for synergy in the partners and the direction of this towards achieving a common goal.[38]

In his account on India, Hall[39] identifies three forms of PPPs: the private distribution of public goods, the private sector purchase of public technology and services and thirdly, public private collaborative research. In the first category, the private sector multiplies and distributes technology derived from the public sector. Hybrid technology is a ready example of this form of PPP and is prevalent in most developing countries. In cases where the public sector has technologies with potential commercial significance, it may sell these technologies to the private sector and in other cases engage in adaptive research services or routine testing commissioned by the private sector. Corporate funding of public research is likely to run into

[37] Byerlee, D., Alex, G. & Echeverría, R., 'The evolution of public research systems in developing countries: facing new challenges' in Byerlee, D. & Echeverría, R., (eds.) *Agricultural research policy in an era of privatization* (Oxon: CABI Publishing, 2002)
[38] Kameri-Mbote *et al*. (2001) *supra* note 33
[39] Hall *et al*. (2002) *supra* note 3

difficulties when issues of undue corporate influence on public research agendas are raised.[40] A third category involves a more complex relationship where both sectors pool resources to take advantage of complementary skills, infrastructure and proprietary science. Differing perspectives on IP are more likely to have the most impact on this category of PPPs. Through the use of the case studies, chapters six and seven look at the impact of IP on food security oriented PPPs and attempt to map IP on the range of concerns between partners.

Conventional analysis of the roles of the public and private sectors in agricultural research has focused on the nature of technology products and the extent to which private organisations will be able to appropriate benefits from investment in R&D.[41] Similarly high rates of return to investments in public sector agricultural research are cited as evidence of 'market failure' and persistent underinvestment by the private sector.[42] Taken together, this type of analysis suggests that there is a natural division between the areas of research that are in the public as opposed to the private domain. The implication is that the boundary between public and private sectors relates primarily to the extent of incentives that encourage the private sector to invest in research and that these incentives can be manipulated through economic policy, intellectual property regimes, tax incentives and funding arrangements.

The motivation for private sector investment in agriculture provides an insight into possible incentives for the sector to collaborate with the public sector. In forming a partnership, partners usually seek to achieve some net gain which they cannot achieve as cheaply, rapidly or effectively on their own. The private sector in many cases hopes to gain from the public sector's wide range of expertise and background research on the technology. In an analysis of partnerships between the private sector and the Consultative Group on International Agricultural Research (CGIAR or CG), Manicad[43] states that the public sector's credibility and the fact that it enjoys more goodwill than the private sector are factors that encourage the private sector to form partnerships with the public sector. In doing so, the former raises its profile and improves its public image. Besides, because of the latter's wide presence (global in the case of the CG), the private sector can expand its scope and clientele while simultaneously enhance its access to technologies held by the public sector. Collaboration

[40] Binenbaum *et al.* (2001) *supra* note 23
[41] See Pray, C. & Umali-Dieninger, D., The private sector in agricultural research systems: will it fill the gap? *World Development* 26 (1998) 1127 for a comprehensive discussion
[42] Thirtle, C. & Echeverría, R., Privatisation and the roles of public and private institutions in agricultural research in sub-Saharan Africa, *Food Policy* 19 (1994) 31
[43] Manicad (1999) *supra* note 22

could potentially lead to the development of a new market for the private sector – those small-scale farmers who are in transition to fuller participation in the market economy. The public sector on the other hand may be motivated by reducing research expenditure and improving its capacity to develop new products. In some cases, collaborating with the private sector may be crucial to the fulfilment of the public sector's mandate where the public sector might not have the comparative advantage to distribute its technologies.[44] The public sector could also benefit from the private sector's management principle of organisational efficiency.[45]

Chapters six and seven examine two case studies: hybrid seed consortia in the International Centre for Research in Semi Arid Tropics (henceforth ICRISAT) and a project on East Coast Fever (ECF) vaccine research at the International Livestock Research Institute (henceforth ILRI). The chapters analyse the motivations behind the respective partners' decisions to form the PPPs.

1.2.4 IP and food security oriented PPPs

Food security oriented PPPs would appear to be constrained by factors such as fundamentally different incentive structures, prohibitive costs and mutually negative perceptions between the sectors.[46] IP directly or indirectly relates to all of these. In addition to having different organisational and operational cultures, the public and private sector have differing perspectives relating to the concept of IP, the ideology behind IPRs, and IP management and strategies. The theoretical conflict between IPRs and the provision of public goods influences the IP policies of public agriculture research institutions including the CG Centres. This theoretical conflict forms the basis of the public sectors' perspective and attitude towards IPRs. The private sector on the other hand finds no conflict in the application of IPRs to achieve its profit objectives. The two sectors' IP policy objectives, management and strategies are generally diametric. These differing perspectives could potentially buttress the conflict of interest between the parties in a PPP and could undermine the achievement of food

[44] and hence Hall's classification of collaboration to include private distribution of public goods mentioned above.
[45] Manicad (1999) *supra* note 22
[46] Spielman, D. & Grebmer K., Public-private partnerships in international agricultural research: an analysis of constraints, *Journal of Technology Transfer* 31 (2006)

security related objectives. However, IP could potentially be exercised in ways that satisfy the needs and concerns of each party in the pursuit of enhanced food security.

Chapter five addresses the public and private sectors' differing perspectives on IP and their potential impact on a food security oriented PPP and advocates for finding the middle ground between the divergent perspectives. Chapter seven looks at how the differing IP perspectives are manifested in the two aforementioned case studies.

One of the main determinants of attitudes and practices towards IPRs is an institution's IP related policies. For the CG Centres, these are informed by international treaties and agreements that are of direct relevance to the Centres. Chapter four examines the main IP related international treaties and agreements and how these influence IP policies at the CG system level. Chapter six conducts a detailed analysis of ICRISAT's and ILRI's IP policies and explores the link between these and the CG system wide IP guidelines and related policy documents while chapter seven looks at how the respective Centres' IP policies are implemented in the context of the case studies.

Since the advent of the international IPR regime, IP law is often assumed to be pervasive and ubiquitous in all research whose results are potentially proprietary. Chapter five tests this assumption by examining the effect that national and international IP law have on the execution of the case studies. It argues that national IP law *per se* is of limited significance to the conduct of research in food security oriented PPPs and that the partnership contract is of more relevance to a PPP. This underscores the need to increase capacity in contract negotiation and IP management especially on the part of public research institutions engaging in food security oriented agricultural research in partnership with the private sector.

1.3 The thesis' contribution

This thesis looks at the hitherto unexplored links between IP and food security oriented PPPs in developing countries. Possible reasons why this has not previously been explored include the fact that such partnerships are few, relatively recent and still ongoing. Literature

tangential to the interface between these three areas has mostly centred on management issues such as the freedom to operate (FTO).[47]

To the author's knowledge, only two studies come close to addressing IP in the context of food security public private partnerships. The first was a Freedom-To-Operate (FTO) analysis of GoldenRice™ (a product of a public private partnership aimed at fortifying rice with Vitamin A) whose objective was to review the IP components associated with GoldenRice™ and provide the relevant institutions with the information needed to develop options for handling the IP in the product and for alternative strategies for managing the IP constraints.[48] The study was essentially a technical risk management opinion with specific terms of reference. It made no attempt to address the relevant institutions' policies or the wider context of the public private partnership. The study was part of the PPP's activities and was aimed at developing a strategy for handling IP. As would be expected of a technical FTO review, its findings are necessarily limited and do not present the overall picture on the links, opportunities and challenges relating to the use of IP in food security oriented PPPs in developing countries. Its findings mainly related to the practical aspects of management of the IP relating to GoldenRice™. The content, analysis and findings of this thesis go further than the FTO review.

The second study examined the role of PPPs in international agricultural research with the aim of providing an understanding of how such partnerships operate and how they potentially contribute to food security and poverty reduction in developing countries. It looked at 75 PPPs in the CGIAR in light of 'persistent market failure, institutional constraints, and systemic weaknesses, which impede the exchange of potentially pro-poor knowledge and technology.'[49] IP was a peripheral issue and was only addressed in the context of the constraints faced by the CGIAR Centres in forming partnerships with foreign companies.

[47] Binenbaum, E., Nottenburg, C., Pardey, P., Wright, B. & Zambrano, P., 'South-North trade, intellectual property jurisdictions and freedom to operate in agricultural research in staple crops' Environment and production technology division discussion paper No. 70 (2003); Pardey, P., Wright, B., Nottenburg, C., Binenbaum, E. & Zambrano, P., 'Intellectual property and developing countries: freedom to operate in agricultural biotechnology' biotechnology and genetic resource policies brief 3 (2003)

[48] Kryder, R., Kowalski, S. & Krattiger, A., *The intellectual and technical property components of pro-vitamin a rice (GoldenRice™): a preliminary Freedom-To-Operate review* (New York: ISAAA, 2000)

[49] Spielman, D., Hartwich, F. & Grebmer, K., 'Sharing science, building bridges, and enhancing impact' IFPRI Discussion Paper 00708 (2007) at p1

The study found that IPRs pose a challenge for the CG Centres; about 51% of the PPPs in their sample involved the use or exchange of proprietary knowledge thereby suggesting that IPR 'is an important issue for consideration in the design and implementation of PPP projects.'[50] This thesis uses this finding and others as the motivation for research. It builds on the results of this second study by analysing the nature of this relevance and the factors that determine the relationship of IP to food security oriented PPPs in developing countries.

This thesis contributes to the field of research in three ways. Theoretically, the thesis:

(i) provides an analysis of private rights and public goods and locates the genesis of the concern over the use of IPRs in the provision of public goods;

(ii) further distinguishes between the *existence* and *exercise* of IPRs and suggests ways in which IPRs can be exercised without compromising the public good mandate characterising research in public institutions; and

(iii) develops a typology of differing perspectives on the concept, ideology and management of IP held by the public and private sectors.

Empirically, the thesis:

(i) analyses the national IP legislation in Kenya and India and its relevance to the execution of food security oriented PPPs; and

(ii) furthers the understanding on the role and relevance of IP to food security oriented PPPs through the lens of the case studies.

The case studies are typical PPPs in food security oriented agricultural research (chapter six); the thesis' findings therefore are instructive to other PPPs with food security objectives in developing countries.

This research finds that IP's significance to a food security oriented PPP is determined by two factors: the nature of the technology used in the partnership and the stage of the partnership. For partnerships with non-proprietary research products, IP is mostly significant at the partnership formation stage and hardly plays a role in the negotiation and execution of the partnership. But of partnerships whose research is potentially proprietary, IP is mostly significant at the negotiation and execution stages and less so at the PPP formation stage. In all cases, other factors such as mutual trust, communication and research competence are

[50] Id at p38

crucial to a partnership's success in achieving its objective. The research also finds that parties' attitudes to IP are influenced by their respective IP policies and their institutional and research cultures.

1.4 Methodology

The nature of developing countries' inexperience with IPRs generally - and more specifically in the agriculture sector - precludes most possibilities for a quantitative evaluation of impacts. In many cases the possible effects of IPRs are compounded with other factors such as national policies and issues relating to trade. As such, the methodology adopted is necessarily qualitative.

In developing countries, differences in the application of IP and variations in the presence of PPPs in the agriculture sector demand that a case study approach be employed. The range of different models of collaboration as well as the variation in national IP regimes, local public institutions, public agriculture policies and presence and type of private sector involvement further advocate for an examination of relatively few cases. A bespoke qualitative analysis of a few PPPs is the preferred method that ensures the influence of factors such as IPRs on a PPP are captured. The thesis examines the PPPs in this specific context.

1.4.1 Research design

This research is based on two case studies found in two developing countries. The first consists of three hybrid parent seed consortia under the International Crop Research Institute for Semi-Arid Tropics (ICRISAT) based in Hyderabad, India while the second is the East Coast Fever (ECF) vaccine research project under the International Livestock Research Institute (ILRI) based in Nairobi, Kenya.

1.4.1.1 India and Kenya

Kenya and India have been chosen as the focus of study for this research because of a number of cognate factors. Apart from the fact that both are developing countries, language is an obvious determining factor. Both countries have well developed agriculture systems which are discussed in chapter two. India has advanced research capacity in plant breeding while Kenya is one of the leaders in agricultural biotechnology in sub-Saharan Africa. India is one

of the largest developing countries with a large and growing market for *inter alia* improved seed; India provides an opportunity to assess the likely impact of a large potential market on private sector investment in agriculture.

PPPs enjoy a significant and growing presence in both countries. An analysis of the case studies will offer useful insights that may be extrapolated to the extent that such qualitative research assists our understanding of the situation in other jurisdictions of the developing world. Kenya has 'comparative advantage' in PPPs in agricultural biotechnology while public private collaboration in plant breeding and in seed systems generally is a common feature in the Indian agricultural system.

The IP regimes in the two countries have evolved though different stages. Although IP protection in Kenya was a colonial heritage (in so far as legislation on IP was inherited from the British after becoming a British colony in 1897) the situation has changed incrementally so that the current legislation on IP is relatively modern having all been enacted (and some amended several times) after independence.[51] Similarly, IP law in India was a British legacy. Revisions to the first law on domestic patent rights were based on the British Patent Act of 1852. Subsequently, the Indian Patents and Design Act of 1911 replaced all previous legislation.[52] On gaining independence, the Indian patent system was reviewed and adapted to conform to national goals. This resulted in a significant weakening of the IP system. The reasons for this apparently unusual act are embedded in the broader economic and ideological environment that prevailed in the post independence period.[53] In January 2005, Indian IP law was amended to conform to requirements set by the TRIPs Agreement. The resulting legislation offers more IP protection and has potential to radically change the agricultural scene. Differences in the evolution and development of India's and Kenya's IP environment would help to answer the question of whether certain IP regimes are more favourable to the formation and sustenance of successful PPPs than others.

[51] See Chege, J., *Copyright law and publishing in Kenya*. (Nairobi: Kenya Literature Bureau, 1978) on the historical development of copyright protection in Kenya; see also Kingarui, J., 'Towards a national patent law for Kenya', in Juma, C. & Ojwang J., (eds.) *Innovation & sovereignty: the patent debate in African development*. (Nairobi: ACTS Press, 1989) on the Kenyan patent system

[52] Adelman, M. & Baldia, S., Prospects and limits of the patent provision in the TRIPs Agreement: the case of India, *Vanderbilt Journal of Transnational Law* 29 (1996) 507

[53] Banerji, S., 'The Indian intellectual property rights regime and the TRIPs Agreement' in Long, C., (ed.) *Intellectual property rights in emerging markets* (Washington: AEI Press, 2000)

1.4.1.2 The Consultative Group on International Agriculture Research (CGIAR)

With the possible exception of the Brazilian national agriculture research organisation (EMBRAPA), the CGIAR is currently the largest public investor in agriculture R&D in developing countries. For 2005, the CGIAR received US$450m from contributions of members and non-members and US$10 from income from the CG centres. Its actual expenditure was US$452m.[54] This has made the CG an obvious partner for collaboration from the private sector perspective.[55]

1.4.1.3 ICRISAT, ILRI and the respective PPPs

Within the CG, two institutions stand out: the International Crop Research Institute for Semi Arid Tropics (ICRISAT) in India and International Livestock Research Institute (ILRI) in Kenya. These have been primarily chosen due to their ground breaking initiatives in collaborative research. The partnership model adopted by the ICRISAT parent hybrid seed consortia is pioneering. The ILRI project on development of an East Coast Fever (ECF) Vaccine is likewise the first initiative of its kind within the CG system, and arguably in the entire field of agriculture in the developing world. These two projects are unique and will no doubt provide insights into factors influencing PPPs and will be informative in their contribution on the challenges faced and lessons to be learnt.

1.4.2 Data collection

This research uses a combination of primary and secondary data sources. The introductory chapters are based on primary sources of information such as international treaties, conventions, national Acts of Parliament, policy documents and secondary information from a variety of sources including academic journals, workshop and conference reports, reports of previous studies and other media on the subject.

The chapters on the case studies are primarily based on primary information obtained through interviews conducted during field work in the two countries over a nine week period between

[54] The CGIAR Financial Report 2005 available at www.cgiar.org
[55] Manicad (1999) *supra* note 22 see also Van Wirk, J., Biotechnology and hunger: challenges for the biotech industry, *Biotechnology and Development Monitor* 41 (2000) 2

August and October 2006 and follow up activities until December 2006. The interviewees broadly fall under five categories: (i) ICRISAT and ILRI research staff, IP managers and research directors involved in the respective projects and their respective private sector partners; (ii) personnel in the respective national IP offices and relevant government departments such as science and technology, agriculture and environment; (iii) directors and other personnel in the national agriculture research institutes (NARIs) in the respective countries and representatives from prominent private sector companies and; (iv) select staff of various institutions which facilitate collaboration between private and public partners.

A total of thirty-five semi structured interviews in India and twenty in Kenya were conducted over the nine week period. This data was aggregated and analysed and is used as the main source of information particularly in chapters six and seven. It supplements the primary and secondary sources in the other chapters

1.4.3 Limitation of research

As the selected case studies are ongoing rather than complete, the scope of the changing dynamics of the respective partnerships is only captured until the end of the data collection period (December 2006). The contribution is limited to the lessons learnt so far and the possible way forward. Whether the lessons are applied in the projects and the implications of these on the direction of research and partnership is a matter beyond this thesis and the subject of further and continuous research. Some of the subject matter of the research in the ECF Vaccine project is protected by confidentiality agreements. As a result, the dynamics of the partnership may be informed and influenced by information that the author is not privy to.

Chapter Two

Agriculture in developing countries: the changing scene

2.0 Introduction

The environment under which agriculture R&D is conducted has changed in the last few decades. Global agriculture and food systems are increasingly guided more by markets than state intervention, driven by consumer preferences, influenced by new technologies and integrated through global trade.

Studies in the last two decades indicate that there is increased privatisation in agriculture. This includes privatisation of knowledge: research products and tools used in agriculture research are now more likely than ever before to be protected by IPRs. There are indications that IP is increasingly in use in public agriculture research institutes and in public private partnerships with food security objectives.

Various studies also point to the increased private sector presence in agriculture. This is demonstrated by increase in the number of private sector companies engaging in agriculture research and related activities and the amount of private sector investment and expenditure in agriculture.

This chapter provides a brief overview of the trends and development in agriculture R&D globally and more specifically in Kenya and India. It specifically investigates increasing privatisation in the study countries. It uses three things as indicators of increased private sector presence in agriculture: the number of companies engaging in agriculture over time, amount of private sector investment in agriculture over time, and alliances between the public and private sectors. It looks at the link between IPRs and increasing private sector presence in agriculture and finally assesses the potential impact of all these changes on food security attainment efforts.

It argues that although the public sector is the predominant actor in agriculture in Kenya and India, there is evidence of increasing private sector presence. This generally increases the likelihood of using IPRs in both the private sector and public sector and has heightened the public sector's awareness of IP and its implications on food security. The changes experienced in agriculture research present immense challenges as well as opportunities in the attainment of food security.

2.1 Institutional evolution of agriculture research in developing countries

The late 1960s and early 70s witnessed a breakthrough in food crop technology and a rapid increase in food production. This can be attributed to a combination of several factors. Some of these include firstly, the recognition that reliance on technology transfer from countries in the 'North' to those in the 'South' was not sustainable or appropriate: the technology did not serve the tropical needs of the developing countries.[1] Secondly, the early successes of the Green Revolution particularly in Asia demonstrated the great potential for investment in agricultural research focussed on developing world problems. This together with the world food crisis emphasised the need for rapid growth in food production. Thirdly, a number of economic studies at the time illustrated the positive link between investment in agriculture and the overall economic growth of a country.[2] At the backdrop of these developments was the establishment of Consultative Group on International Agricultural Research (CGIAR or CG) in the 1970s.

The development of public research systems varied considerably by region and country. In sub Saharan Africa, many countries inherited the agriculture research infrastructure established by former colonial powers. Some of these did not necessarily address the countries' needs. The countries at the time were preoccupied

[1] Byerlee, D., Alex, G. & Echeverria, R., 'The evolution of public research systems in developing countries: facing new challenges' in Byerlee, D. & Echeverria, R., (eds.) *Agricultural research policy in an era of privatisation* (Oxon: CABI Publishing, 2002)

[2] Neoclassical agricultural economists who championed this view included Nicholls, W., 'The place of agriculture in economic development' in Eicher, C. & Witt, L., (eds.) *Agriculture in economic development* (New York: McGraw-Hill, 1964); Johnston, B. & Mellor, J., The role of agriculture in economic development, *American Economic Review* 51/4 (1961) 566; Ranis, G. & Fei, J., A theory of economic development, *American Economic Review* 51/4 (1961) 533; Ranis, G. & Fei, J., Innovation, capital accumulation, and economic development, *American Economic Review* 53/3 (1964) 283; and Ranis, G. & Fei, J., *Development of the labour surplus economy: Theory and policy* (Homewood: Richard D. Irwin, 1964).

with building capacity to replace expatriate staff and enhancing the research infrastructure.[3] Investment in institutional reform in Asia generally began earlier than it did in sub-Saharan Africa and benefitted from a longer period of support.[4]

A defining characteristic of public research in developing countries in all regions was the trend toward establishing national agriculture research organisations. By the 1980s, the focus on reform had turned towards improving the effectiveness of national agricultural R&D which involved integrating research activities within a single agency, coordinating and developing national agricultural research plans and improving management practices such as planning, monitoring and evaluation.[5]

Universities generally played a limited role in applied research in developing countries except perhaps in countries such as India which have a grant system where the mandate for applied research is explicitly given to the universities.

In the late 1980s, the golden era of public agriculture research in developing countries was declining. Public agriculture research expenditures stagnated mainly due to fiscal austerity as a result of structural adjustment programmes and policy reform and other factors such as competition from other sectors for scarce public funds, and a growing decline in commodity prices.

2.2 Increased privatisation and commercialisation

The small potential for private returns historically left crop research and development largely in public research institutions.[6] Until the green revolution and the global food crisis in the 1980s, the public sector mainly focused on cash crops. The emphasis was inevitably directed to food crops during the food crisis.[7] The public sector's research agenda has since expanded and a more commercial focus has been adapted. In

[3] Roseboom, J., Pardey, P., & Beintema, N., 'The changing organisational basis of African agricultural research' EPTD Discussion Paper no. 37 (Washington DC: IFPRI, 1998)
[4] Byerlee & Echeverria (2002) *supra* note 1
[5] Beintema, N. & Stads, G., Sub-Saharan African agricultural research: recent investment trends, *Outlook on Agriculture* 33/4 (2004) 239
[6] Alston, J. M., Pardey, P.G. & Taylor, M. J., (eds.) *Agricultural science policy: Changing global agendas* (Baltimore: John Hopkins University Press, 2001)
[7] For an account on how the public sector has evolved, see Byerlee *et al.* (2002) *supra* note 1

developing countries, budgetary austerity in the late 1980s and in the 1990s saw public spending on agriculture drastically reduced. The public sector had to adapt to this through the creation of new institutional models to confront with the challenges. This involved in some cases an evolution from centralised public research institutes to more diverse research systems.[8] In more recent years, reforms have moved towards issues such as redefining the government's role in agriculture research, decentralising decision making processes, increasing stakeholder participation, identifying new sources and mechanisms of funding and strengthening system linkages.[9] Most agricultural public research institutes are now commodity oriented and have adopted a 'supply driven' research agenda.

Although the private sector had had some presence in the agricultural scene, it was at this time following the budgetary austerity period that its presence in agriculture became more entrenched.[10]

2.2.1 Privatisation defined

This chapter adopts a general definition of privatisation: the shift of activities, functions, responsibilities or the production of goods and services in whole or in part from the public sector to the private sector. It also covers the privatisation of knowledge where knowledge is owned by identifiable legal entities as opposed to being owned by 'the public.' It connotes a transfer of ownership or control from the public to the private sector and at a lower level, from the public domain to a legal person. Commercialisation on the other hand is used to describe the shift not from one sector to another but the change in an organisation's outlook relative to the market; its effect is to put the enterprise on a commercial footing, to orient it toward the market. Commercialisation of research products is often viewed in this context.

This chapter shows that there is increasing privatisation of agriculture research in developing countries. To assess the trend towards privatisation, the following section

[8] Id
[9] Chema, S., Gilbert, E. & Roseboom, J. 'A review of the key issues and recent experiences in reforming agricultural research in Africa' Research Report no. 24 (The Hague: ISNAR, 2003)
[10] Graff, G., Cullen, S., Bradford, K., Zilberman, D. & Bennett, A., The public-private structure of intellectual property ownership in agricultural biotechnology, *Nature Biotechnology* Volume 21/9 (2003)

presents time-series data relating to the number of private enterprises engaging in agriculture and the amount of private investment in agriculture. Public private partnerships (PPPs) are also looked at as indicators of increased private sector presence while the link between IPRs and increased private sector presence is analysed conceptually.

2.2.2 Evidence of privatisation

2.2.2.1 Funding[11]

Globally, public agriculture research expenditure amounted to nearly US$21.7m in 1995, almost double the amount in 1976. Just under half (47%) of this was in developed countries. Asia, excluding China, accounted for 21% while sub Saharan Africa accounted for a further 5.8%. In the 1990s, for the first time, developing countries as a group spent more than developed countries on public agricultural research; the group's research expenditure grew by 50% in the 1985 – 1995 decade compared to a more moderate growth of 16.7% in public agriculture expenditure in developed countries. According to the estimates, developing countries account for nearly 53% of the total global public agriculture expenditure.

Table 2.1: Global public agricultural research expenditures, 1976-1995 (1993m international dollars)

expenditures	1976	1985	1995
Developing countries	4738	7676	11469
Sub Saharan Africa	993	1181	1270
China	709	1396	2063
Asia and Pacific, excluding China	1321	2453	4619
Latin America and the Caribbean	1087	1583	1947
Middle East and North Africa	582	981	1521
Developed countries	7099	8748	10215
Total	11837	16424	21684

Source: Pardey & Beintema, 2001

On the other hand, the private sector spent an estimated US$13,446m in 2000 on agriculture R&D up from US$11,511m in 1995; more that a third of global total

[11] Data relating to private investment in agriculture are difficult to collect. Generally, there are no comprehensive and uniformly generated data of private sector expenditure in agriculture particularly in developing countries. The data available in a few sources are not strictly comparable owing to the different methods of data collection and definitions. Data from central sources rely on the submission by private companies which may not provide the information every year. The author has attempted to provide the best available data.

agriculture expenditure in 2000 was private. The private sector plays a bigger role in developed than in developing countries accounting for 51.5% in 1995 and 55.2% in 2000 of total expenditure in developed countries compared to 5.5% and 6.3% respectively in developing countries. Moreover, of the total investments in agriculture R&D, only 2% in 1995 and 2.3% in 2000 were derived from private firms in developing countries.

Table 2.2: Public and private sector expenditure in agriculture research, 1995 & 2000 (1993 million international dollars)

	1995				2000				% Growth 1995-2000	
			% share				% share			
	Public	Private	Public	Private	Public	Private	Public	Private	Public	Private
Developing countries	11469	672	94.5	5.5	12819	869	93.7	6.3	11.7	29.3
Developed countries	10215	10829	48.5	51.5	10191	12577	44.8	55.2	(0.23)	16.1

Sources: Pardey & Beintema (2001) for 1995 figures and CGIAR Science Council (2005) for 2000 figures

Although the private sector is clearly a small player in developing country agriculture R&D, its growth from US$672m in 1995 to US$869m in 2000 represents a 29.3% growth rate compared to 16.1% growth rate in developed countries. The private sector is thus growing at a faster rate in developing countries.

In India, with the exception of some vegetable seed production, private sector presence in agriculture was not significant until the mid 1980s. Since then private research in India has grown absolutely and relatively mirroring the trend in developing countries. It has more than doubled within the decade between 1985 and 1995 compared to a more modest growth in public sector expenditure and accounted for about 14% of the total agriculture research investment. In a study conducted on Asian countries including China, the largest amount of private research was found to be in India where investment was about US$55 million per year in the mid 1990s.[12] However, the private research intensity (research investment relative to the size of a country's agricultural economy) in India was less than 1% although it doubled between 1985 and 1995.

[12] Pray, C. & Fuglie, K., 'Private investment in agricultural research and international technology transfer in Asia' Economic Research Service Technical Report 805 (Washington DC: United States Department of Agriculture, 2001a); Pray, C. & Fuglie, K., 'Policies for private agricultural research in Asian developing countries' in Petes, G. & Pingali, P., (eds.) *Tomorrow's agriculture: Incentives, institutions, infrastructure and innovations* (Hants: Ashgate, 2001b)

Table 2.3: Public and private agriculture expenditure in India, 1985 and 1995 (1995 US$ million)

Year	Agriculture expenditure		% share	
	Public	Private	Public	Private
1985	206	26	88.8	11.2
1995	348	56	86.1	13.8
Growth rate 85-95 (%)	69	115		

Source: Pray & Fuglie (2001)

From the above, it is clear that private sector expenditure in agriculture in India grew absolutely and relatively between 1985 and 1995. More recent data on capital formation seems to corroborate the increase in private sector engagement in agriculture in India. Gross capital formation is the sum of acquisitions including improvements on fixed assets and increase in the value of finished goods.[13] It shows that the share of private sector in gross capital formation in agriculture is on an upward trend.

Table 2.4: Gross capital formation in Agriculture in India, 1995-2003 (100,000 Rupees)

Year	Gross capital formation in agriculture		% share	
	Public	Private	Public	Private
1995-96	4849	10841	30.9	69.1
1996-97	4668	11508	28.9	71.1
1997-98	3979	11963	25	75
1998-99	3870	11025	26	74
1999-2000	4221	13083	24.4	75.6
2000-01	3927	12979	23.2	76.8
2001-02	4127	13201	23.8	76.2
2002-03	4538	14119	24.3	75.7

Source: Central Statistical Organisation (2003)

Gross capital formation is an indicator of investment and in this case is a proxy of private sector presence in agriculture. It shows that firstly, most (75.7% in 2003) of the value added in agriculture is from the private sector and secondly, that this has been on a steady increase since 1995 save for a couple of dips. Although this data is not able to definitively show the state and trend of private sector investment in *actual* research it nevertheless tells us that private sector investment in agriculture has increased as far as investment in fixed assets and value addition is concerned. In terms of total actual R&D investment, the public sector was the predominant sector with a share commanding 86% (table 2.4) although private expenditure increased by 115% between 1985 and 1995.

[13] A strict definition is neither intended nor attempted.

In Kenya, recent estimates on public and private expenditure in agriculture show that the private sector grew from US$0.8m in 1991 to US$1.5m in 2000, a growth of 87.5%. Annual growth varied greatly within this period although public investment in agriculture was by far more erratic and had, in 2000, increased by about 21% of the 1991 levels. This erratic public spending behaviour is reflective of the strained relationship with donors and development aid resulting in irregular levels of public spending during the period. The private sector's share increased from 2% in 1991 to 3% in 2000. The private sector accounted for almost 3.5% in 1998; its expenditure in this period was stagnant and its share increased only because of an acute drop in public sector spending.

Table 2.5: Public and private agriculture expenditure in Kenya, 1991-2000 (2000 US$ million)

Year	Agriculture expenditure		Total	% share	
	Public	Private		Public	Private
1991	37	0.8	37.8	97.9	2.1
1992	35.5	0.9	36.4	97.5	2.5
1993	45.8	1	46.8	97.9	2.1
1994	57.1	1	58.1	98.3	1.7
1995	47.7	1.2	48.9	97.5	2.5
1996	54.9	1.4	56.3	97.5	2.5
1997	39.2	1.3	40.5	96.8	3.2
1998	36.3	1.3	37.6	96.5	3.5
1999	42.5	1.3	43.8	97.0	3.0
2000	45	1.5	46.5	96.8	3.2

Source: IFPRI, ASTI database available at www.ifpri.org

2.2.2.2 Increase in number of private sector companies engaging in agriculture

A distinction between the foreign and local private sector is useful. In 1995, about a third of private research in India was conducted by foreign firms.[14] This was mainly in seed and pesticide research. About 40% of the research on seed and livestock was similarly conducted by foreign firms.[15]

[14] Pray & Fuglie (2001a) *supra* note 12
[15] Id

In the seed industry, foreign firms accounted for about a third of the private seed market with large Indian firms accounting for 23%.[16] India has a large number of seed firms although only a few have large operations. About half of seed sales are by private companies.[17] Most seed firms conduct breeding in hybrid crops mainly with inbred lines developed in the public sector including international agriculture research centres. A few large companies (mostly foreign) have programmes that conduct research to develop their own inbred lines.[18] Some local companies collaborate with overseas companies for access to proprietary tools and technologies. Private hybrids now account for a significant proportion of the market for sorghum, maize, and cotton.[19]

Developments in biotechnology have further strengthened the trend: private investment in agriculture biotechnology outpaces public investment. Genetically modified crops in India have been developed by a handful of private multinational corporations. In the period between 1996 and 2001, private firms accounted for about 95% of applications for field trials[20] demonstrating the dominance of the private sector over the public sector in transgenic agriculture.

Studies conducted by the Biotech Consortium India Limited (BCIL) in 2001and 2003[21] show that total biotechnology firms increased from 176 in 2001 to 401 in 2003. The number of private firms conducting agriculture biotech increased from 85 to 132 and as at 2003, agriculture's share of total biotechnology activity in India was 32.9%.

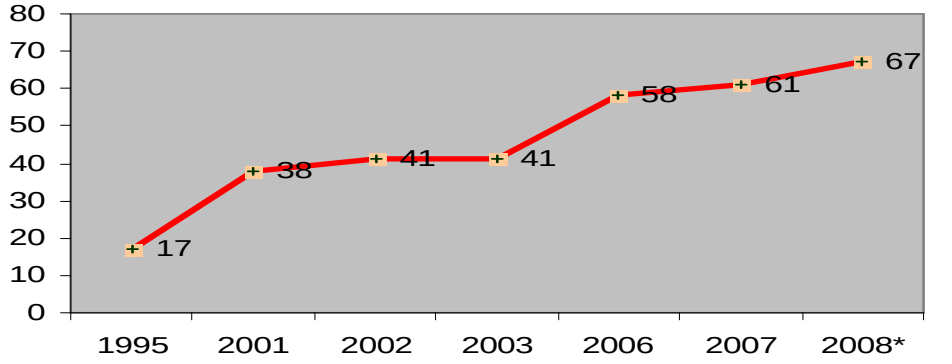
In Kenya, the public sector still conducts the majority of agriculture research. Data on private sector research activity is hard to find and what is available is dated. A national survey of private R&D activity in 1988 in all sectors showed that agriculture

[16] Pray, C. & Kelly, T. Impact of liberalisation and deregulation on technology supply by the Indian seed industry (Hyderabad: ICRISAT, 1998); Pray, C. & Basant, R., 'India' in Pray & Fuglie (2001a) *supra* note 12
[17] ICAR, pers. comm.
[18] ICAR, pers. comm.
[19] Singh, R., Pal, S. & Morris, M. Maize research, development, and seed production in India: Contributions of the public and private sectors (Mexico, DF: CIMMYT, 1995)
[20] Pray & Fuglie (2001a) *supra* note 12
[21] Biotech Consortium India Limited., *Directory of Biotechnology Industries and Institutions in India* (New Delhi: BCIL, 2001); Biotech Consortium India Limited., *Directory of Biotechnology Industries and Institutions in India* (New Delhi: BCIL, 2003)

accounted for 42% of private R&D activity and 60% of the full time research scientists engaged in private companies.[22]

Data from the Seed Traders' Association of Kenya (STAK) suggests that the number of private companies in agriculture is on a steady increase. STAK's membership increased by almost 300% from 17 in 1995 to 67 in 2008. 90% of all seed from the private sector is supplied by STAK members although only about half of private seed traders are members of STAK. Virtually all members of STAK join in the first year of their establishment.[23] Although figures from STAK do not present the whole picture on the growth of private sector in agriculture, they however indicate that this is occurring. That seed companies join within a year of their establishment suggests that the growing number of STAK members corresponds to the growing number of total private seed traders.

Figure 2.1: STAK membership, 1995-2008



* until August 2008; data not available for 1996-2000, 2004-2005

Source: compiled using data from STAK

In agriculture research capacity, the private sector accounted for only 1.3% of all full time employees in agriculture in 2000. This is the highest share the private sector had between 1991 and 2000. In that period, research capacity in private sector grew by 57% while it dropped by 13.7% in the public sector. The public sector nevertheless has 98.6% of the total research capacity. This suggests that the private sector plays a stronger role in funding agricultural research as opposed to performing research itself.

[22] Makau, B., 'Survey on private sector research and development resources and activities in Kenya' National Council of Science and Technology (NCST) Publication No. 26 (Nairobi: NCST, 1988)
[23] Seed Traders' Association of Kenya (STAK), pers. comm.

It is probable that many private companies contract the public sector to perform research on their behalf.

Table 2.6: Agriculture research capacity in Kenya, 1991-2000 (FTE)

Year	FTE Researchers		% share	
	Public	Private	Public	Private
2000	822.3	11	98.7	1.3
1999	868.6	10	98.9	1.1
1998	879.5	9	99.0	1.0
1997	892.2	7	99.2	0.8
1996	907.3	8	99.1	0.9
1995	908.4	9	99.0	1.0
1994	928.5	11	98.8	1.2
1993	955.6	9	99.1	0.9
1992	961.5	9	99.1	0.9
1991	953	7	99.3	0.7

Source: IFPRI, ASTI database available at www.ifpri.org

Similar to foreign private sector engagement in India, foreign private sector activity in Kenya is mainly on the provision of input technologies most of which are produced in the developed world; virtually all foreign private sector companies are multinationals. The local private sector mainly engages in seed production and other plant breeding activities. Farmer organisations in sectors such as tea and coffee are also part of the local private sector. These finance their respective research institutes through levies on marketed output.

Like in India, agriculture biotechnology is an area where private sector presence has increased. In Kenya, research in biotechnology is public sector led although government funding is minimal; most of the funding comes from bilateral donors and is almost always project specific. Virtually all experimentation in agriculture (and health) biotechnology involving private companies occurs in partnership with government institutions as required by law. There is therefore an emerging pattern of public private partnerships. Private sector involvement in biotechnology is all foreign.[24] There are no local private companies engaging in agricultural biotechnology.

The horticultural industry is another sector which has seen an increase in private sector activity; virtually all the private horticultural companies in Kenya are foreign although there are indications that their activity may have led to local spin off companies which are subcontracted by the main foreign companies. About 90% of all

[24] National Council of Science and Technology (NCST), pers. comm.

research activity is conducted by private companies.[25] The horticulture industry has grown rapidly since the mid 1980s in terms of research expenditure, number of actors involved, produce earnings and export sales. A survey of plant variety protection data shows that Kenya is a technology importer in horticulture corroborating the suggestion that the foreign private sector dominates in horticulture: foreign enterprises make up 95% of all horticultural PBR applications.[26]

Statistics relating to plant variety release show that 22 maize varieties were released in Kenya between 1960 and 1999 all of which were from the public sector. Between 2000 and 2003, the public sector released 8 maize hybrids compared to the private sector's 47 maize varieties.[27] This clearly shows increased private sector involvement in plant breeding.

2.2.2.3 IPRs and increasing private sector presence in agriculture

IP and privatisation of knowledge

With regard to privatisation and increased private sector presence, IPRs may be analysed on two levels: as an indicator of privatisation and as a factor motivating private sector investment. In this regard, privatisation is taken to mean the transfer of control or ownership from the public domain to a legal person. The presence of IPRs *indicates* privatisation of the technology protected; privatisation in this regard refers to the privatisation of knowledge. A general assumption is that a higher incidence of IP protection directly correlates with increased privatisation i.e. IPRs imply the privatisation of knowledge.

Ownership and control are central to privatisation: IPRs accord the right holder ownership and control of the protected technology. Although the publication requirement in patents for example, ensures information relating to the technology is placed in the public domain, only the right holder and/or those authorised by him have

[25] Kenya Fresh Produce Exporters Association of Kenya (FPeak), pers. comm.
[26] Kenya Plant Heath Inspectorate Service (KEPHIS), pers. comm.
[27] Louwaars, N., Tripp, R., Eaton, D., Henson-Apollonio, V., Hu, R., Mendoza, M., Muhhuku, F., Pal, S. & Wekundah, J., *Impacts of strengthened intellectual property rights regimes on the plant breeding industry in developing countries: a synthesis of five case studies* (Wageningen: Centre for Genetic Resources, 2005)

control of the protected technology. IPRs are therefore an example of privatisation of knowledge.

If privatisation is taken to mean transfer of control or ownership from the public to the private *sector*, IP protection does not necessarily mean that protected technology or products are moved from the public to the private sector. This is largely determined by how the right holder, whether in the public or private sector, chooses to exercise his IPRs. Of course the fact that it is up to the right holder to determine how to exercise the IPRs means that he has the ultimate control of the IPRs. The exercise of IPRs as distinguished from the existence of IPRs is addressed in chapters three and four.

Increase in the public sector's awareness of IPRs and related issues is often attributed to the public sector's exposure to the private sector practices. Use of IPRs in the public agriculture research institutions is often prefaced by factors such as the advent of the international IPR regime and collaboration with the private sector. The inference is that IPRs are mainly used by the private sector and that by engaging in agriculture, the private sector 'imports' the usage of IPRs to others in the agriculture sector including public research institutions. From this perspective, it may be argued, at least in theory, that the increase in private sector presence increases the likelihood of using IPRs in agricultural research by both the private and public sectors. Empirical research would of course be crucial in defining the argument. It may be that private companies in a particular context are no more likely to use IPRs than their public sector counterparts.

IP as a factor contributing to private sector presence

This subsection enquires whether IPRs have helped increase private sector presence in agriculture particularly in Kenya and India. Indirectly, it looks at why private sector presence has increased in agriculture and whether IPRs have played any role in this. As argued above, IPRs accord the right holder ownership and control of the protected technology. The classic economic rationale assumes that the right holder will exercise his right to appropriate the benefits offered by the protection. It is this assumption of appropriation of benefits that IPR proponents argue is a factor motivating private sector investment in any field including agriculture.

Various studies have in the past tried to link IPRs with private research. A study by Park and Ginarte[28] showed that IPRs had a positive impact on private research. Another study by Kanwar and Evenson[29] showed that IPRs had a strong positive effect on innovation. With regard to agriculture, various authors have argued that IPRs improve incentives to plant breeders thereby increasing technology transfer and spillovers to farmers.[30] However, empirical analysis of the impact of IPRs particularly in developing countries is lacking; the results from studies are inconclusive and often contradictory. For example, one study of Latin American countries found that PBR incentives had a significant and positive effect on private wheat breeding in Argentina but not in Chile[31]; another concluded that at best, PBR certificates had limited effect in stimulating private sector investment in agriculture in the US[32]; another study two decades later argued that PBR certification in the US resulted in neither an increase in private investment in wheat breeding nor an increase in experimental or commercial wheat yields.[33]

In a relatively recent study of the impact of IPRs in plant breeding in India, China, Columbia, Uganda and Kenya, the authors argue that plant variety protection is not necessary for initial private seed sector development but may contribute to further

[28] Park, W. & Ginarte, J., 'Intellectual property rights and economic growth' (Washington DC: American University, 1996). The study however found that IPRs did not have a measureable impact on economic growth although there was a positive correlation between IPR and research investments and between research investments and economic growth.

[29] Kanwar, S. & Evenson, R., Does intellectual property protection spur technological change? *Oxford Economic Papers* 55 (2003) 235

[30] Such authors include Nottenburg, C., Pardey, P. & Wright, B., 'Addressing freedom to operate questions fro international agricultural R&D' in Pardey, P. (ed.) *The future of food: biotechnology markets and policies in an international setting* (Washington DC: International Food Policy Research Institute, 2001); Lele, U., Lesser, W. & Horstkotte-Wesseler, G., *Intellectual property rights in agriculture* (Washington DC: World Bank, 2000); see also Fuglie, K., Ballenger, N., Day, K., Klotz, C., Ollinger, M., Reilly, J., Vasavada, U. & Yee, J., 'Agricultural research and development: public and private investments under alternative markets and institutions' Agricultural Economics Report 735 (Washington DC: USDA, 1996)

[31] Pray, C., 'Plant breeders' rights legislation, enforcement and R&D: lessons for developing countries' in Peters, C. & Stanton, B., (eds.) *Sustainable agricultural development: the role of international cooperation* (London: Dartmouth, 1992); this was also confirmed by Van Wijk, J. 'The impact of plant breeders' rights in developing countries: Results of a study in five Latin American countries' in van Wijk, J. & Jaffe, W., (eds.) *Intellectual property rights and agriculture in developing countries* (Amsterdam: University of Amsterdam, 1996)

[32] Butler, L. & Marion, B., 'The impacts of patent protection on the US seed industry and public plant breeding' North Central Regional Research Publication 304 (Madison: University of Wisconsin, 1985)

[33] Alston, J. & Venner, R. The effects of the US Plant Variety Protection Act on wheat genetic improvement *Environment and Production Technology Division Discussion Paper* 62 (Washington DC: IFPRI, 2000)

growth and diversification.[34] They conclude that identifying clear causality of IPRs and private sector engagement in agriculture in the study countries is difficult although this does not mean that IPRs are unimportant.

Appropriation of benefits from new technology is a factor generally motivating private sector investment. It is however worth noting that there are other means of appropriation of benefits besides IPRs (including trade secrets) in plant breeding. Examples of these other mechanisms include hybrid technology and purchase agreements. Hybridisation offers biological protection: seed replanted from hybrids lose their vigour and quality therefore seed saving of hybrids is not an issue; farmers have to plant new hybrid seed every season. Because hybrids lose their vigour, they cannot meet the DUS[35] criteria necessary for protection and are therefore not subject to plant breeders' rights. In the case of maize in Kenya, hybridisation appears to offer more incentive to farmers than the possibility of seeking PBRs: private seed companies invest in maize hybrids rather than the open pollinated varieties (OPVs)[36] which are protectable by PBRs. The same is witnessed in Asia where private sector investment is mostly in hybrids.[37]

Appropriation through PBRs does not explain private sector investment in OPV rice varieties in India in the absence of PBRs. For example, in Andhra Pradesh, more than half of the state's rice seed is provided by the private sector; this is virtually all OPV and was, as at 2007 unprotected by PBRs as the plant variety protection law in India was yet to be implemented.[38] The growth of the seed industry in India has been occurring since the mid 1980s; the plant variety protection law was only implemented in 2007. In Kenya, the Kenya Seed Company, a large parastatal and at least two other companies produce and market their own maize OPVs; these are yet to apply for

[34]Louwaars *et al.* (2005) *supra* note 27
[35] Distinctness, Uniformity and Stability; the parent lines used in the hybrid can however be protected by PBRs where they are not hybrids themselves.
[36] STAK, pers. comm.; KEPHIS, pers. comm.
[37] Gerpacio, R., The roles of public sector versus private sector in R&D and technology generation: the case of maize in Asia *Agricultural Economics* 29/3 (2003) 319 shows this in private sector investment in hybrid maize; Pray, C., Ramaswami, B. & Kelly, T., The impact of economic reforms on R&D by the Indian seed industry *Food Policy* 26 (2001) 587 show private sector investment in hybrid rice and rapeseed
[38] Indian Council of Agricultural Research (ICAR), pers. comm. See also Louwaars *et al.* (2005) *supra* note 27

PBRs.[39] These examples suggest that there are other factors motivating private sector investment in agriculture. It is also evident that IPRs are not equally relevant across all agriculture subsectors.

Literature in agricultural economics include other "push" and "pull" factors motivating private sector research in agriculture whose analysis is beyond the remit of this chapter. These are the size of the potential market for new products, the cost of developing new technology, the role played by the public sector, trade and market liberalisation, and other components that contribute to the general business climate. Three of these warrant brief mention.

The influence of the market size on entry into e.g. plant breeding is straightforward. Various empirical studies have showed that the larger the perceived size of the potential market, the greater the probability of entry.[40] The structure of the market also determines the level and magnitude of private sector entry. State owned seed monopolies and in some instances public sector projects pose significant entry barriers to the private sector or in some cases crowd out the private sector where it exists.[41] The market size and liberalisation hypotheses find particular strength in India where rapid private sector growth followed the seed liberalisation policies in the 1980s. Reforms during this period included elimination of entry restrictions for foreign firms and large Indian conglomerates and the promulgation of new seed laws that reduced the restrictions on imports of varieties as well as germplasm for research purposes.[42]

Another determinant of private sector investment in agriculture worth mentioning is the role played by the public sector. Public research helps to keep private research costs down; the cost of private research is reduced by spillovers generated from public

[39] KEPHIS, pers. comm.
[40] Naseem, A., Omamo, S. & Spielman, D., 'The private sector in agricultural R&D: policies and institutions to foster its growth in developing countries' ISNAR Discussion Paper 6 (2006); Griliches, Z. Hybrid corn: An exploration in the economics of technological change, Econometrica 25 (1957); Griliches, Z., *R&D and productivity* (Chicago: University of Chicago Press, 1998); Scherer, F., Demand-pull and technological innovation: Schmookler revisited, *Journal of Industrial Economics* 30/3 (1982) 225; and Scherer, F., Inter-industry technology flows and productivity growth, *Review of Economics and Statistics* 64 (1982) 627
[41] Alfranca, O. & Huffman, W., Aggregate private R&D investments in agriculture: The role of incentives, public policies, and institutions, *Economic Development and Cultural Change* 52/1 (2003) 1
[42] Pray, C. & Umali-Deininger, D., The private sector in agricultural research systems: Will it fill the gap? *World Development* 26/6 (1996) 1127

research.[43] 1995 figures on sources of germplasm used in the local private sector maize breeding programmes in India show that 38% were from private sources while the rest were from the public sector including IARCs.[44] A survey of Indian private plant breeders found that the public research system has been a major source of breeding material for cotton and sorghum while the International Crops Research Institute for Semi Arid Tropics (ICRISAT, an IARC) is a major source of germplasm for sorghum and millet supplying about 65 and 80 percent respectively to the private sector.[45]

Public research provides technology to improve seed companies' appropriability. For example, hybrid rice is the focus of much private research in India whose origin can be traced to research carried out by the International Rice Research Institute and national government programmes that developed hybrid rice technology for the tropics.[46] The public sector also provides knowledge and competent human resources to the private sector. [47]

Contributions of public research may in part explain private sector investment in agriculture biotechnology. The situation here is a bit different in that any public contribution is mainly from the 'international public' rather than the local or national public research system. This is more the case in Kenya where all private research in biotechnology is foreign. In India, anecdotal evidence suggests some form of spillovers from the public to the local private sector and vice versa.[48]

Apart from the biotechnology spillovers from the public sector, the technological opportunity itself that is provided by biotechnology is another factor motivating private investment in agriculture biotechnology. Advances in biotechnology have the potential to reduce the cost of further research. Biotech tools such as molecular

[43] Pray, C., 'The growing role of the private sector in agricultural research' in Byerlee & Echeverría (2002) *supra* note 1
[44] Tripp, R. New seed and old laws: regulatory reform and the diversification of national seed systems (London: Overseas Development Institute, 1997)
[45] Ramaswami, B., Pray, C. & Kelley, T., Dissemination of private hybrids and crop yields in the semi-arid tropics of India, *Indian Journal of Agricultural Economics* 57/1 (2002) 39
[46] Pray & Fuglie (2001a) *supra* note 12
[47] Manicad, G. CGIAR and the Private Sector: Public good versus proprietary Technology in Agricultural Research, *Biotechnology and Development Monitor*, No. 37 (1999) 8
[48] ICAR, pers. comm.

markers that were previously used in limited areas e.g. high value crops are now in use in grains such as maize and rice. Similarly, the cost of producing plants resistant to pests such as bollworms in cotton has been reduced by the availability of Bt genes that can be transferred to cotton, rice and most other crops. Of course the cost reductions are still limited but there's potential for growth. The more opportunities private companies have to transform the available stock of knowledge into commercially viable technology, the more likely they are to invest. It is not surprising therefore that advances in molecular biology, bioinformatics, genetics, biochemistry and related fields have resulted in private sector investment in agriculture biotechnology.

2.2.2.4 PPPs as indicators of privatisation

In today's globalised world, conflict, complexity, interdependence and cooperation characterise both the nature of problems actors in all sectors face and of the solutions they pursue. Convergence of synergies, linkages and concerted efforts among governments, private sector, civil society groups and individuals are one of the few effective ways of dealing with modern complex problems.

Partnerships between the public and private sectors are currently enjoying remarkable acclaim in both official and scholarly circles[49]; they are seen as a means of addressing broad and multifaceted problems that defy clear definition and have no simple solutions. This is especially so in development rhetoric characterised by multiple stakeholders, competing interests and multifarious issues.

[49]Kettler, H. & Towse, A., (2002) *Public-private partnerships for research and development: medicines and vaccines for diseases of poverty* (London: Office of Health Economics); Buse, K. & Walt, G., Global Public-private partnerships: part II- What are the health issues for global governance? *Bulletin of the World Health Organisation* 78/5 (2000) 699; Smith, R., Vaccines and medicines for the world's poorest: public-private partnerships seem to be essential, *BMJ* 320 (2000) 952; Graff, G., Roland-Holst, D. & Zilberman, D., 'Agricultural biotechnology and globalisation: the role of public and private sector research' paper presented at the 'Workshop on Environmental Costs and Benefits of Transgenic Crops in Europe' 2-4 June (2003); Pray, C., Public-private sector linkages in research and development: Biotechnology and the seed industry in Brazil, China and India, *American Journal of Agricultural Economics* 83/3 (2001) 742; and Huang, J., Rozelle, S., Pray, C. & Wang, Q., Plant Biotechnology in China, *Science* 295/5555 (2002) 674

Table 2.7: Major partners in 13 Kenyan-based agricultural biotech projects

Projects (facilitating organisation)	Major partners
Development of drought-tolerant and pest/insect resistant maize varieties (BTA facilitated)	KARI, Biotechnology Trust Africa (BTA), Dutch Government Ministry of International Development & Cooperation (DGIS), the International Maize and Wheat Improvement Centre (CIMMYT), University of Missouri-Columbia and Brookhaven National Laboratories
Citrus tree tissue culture project for the mass propagation of clean planting material (BTA)	National Horticulture Research Centre/KARI, University of Nairobi, BTA, DGIS
Banana tissue culture project for mass propagation of clean planting material (BTA)	KARI, Jomo Kenyatta University of Agriculture and Technology, BTA, DGIS, Rockefeller Foundation, UNESCO, World Bank, USAID and Rutgers University
Irish potato tissue culture project for mass propagation of clean planting material (BTA)	National Potato Research Centre/KARI, BTA, DGIS
Sweet potato and cassava tissue culture project for mass propagation of planting material (BTA)	KARI, BTA, DGIS, International Institute for Tropical Agriculture and the International Potato Centre (CIP)
Evaluation & promotion of *Bacillus thuringiensis* (*Bt*) toxin-based biopesticides (BTA)	KARI, University of Nairobi, BTA, DGIS, Kenyan Industrial Research and Development Institute (KIRDI), International Centre of Insect Physiology and Ecology (ICIPE), International Crop Research Institute for Semi Arid Tropics (ICRISAT)
Macadamia tissue culture project for mass propagation (BTA)	KARI, BTA, DGIS, Japan International Cooperation Agency, World Bank
Biotech to benefit small scale banana producers in Kenya (ISAAA)	KARI, Rockefeller Foundation, International Development Research Centre/Canada, (ISAAA)
Virus resistant sweet potato (ISAAA)	KARI, Monsanto, CIP
Understanding the mechanisms of maize streak virus resistance of maize lines from Kenya & eastern and southern Africa (ISAAA)	KARI, Rockefeller Foundation, John Innes Centre/UK, University of Cape Town, ICIPE, Norvatis Seeds
Transgenic cassava project (ISAAA)	KARI, Moi University, USAID, Danforth Centre
Insect resistant maize for Africa (IRMA) project (CIMMYT)	KARI, CIMMYT, Syngenta Foundation
Development of a vaccine against East Coast Fever (ILRI)	KARI, International Livestock Research Institute (ILRI), Oxford University, Merial Ltd, University of Victoria/Canada, Department for International Development/UK, Edinburgh University/UK, TIGR

Source: Ayele, et al. (2006), with modifications

Although PPPs may not, strictly speaking, be indicators of increased privatisation, they are nevertheless a useful proxy of private sector engagement and involvement in

agricultural research. At the very least, PPPs suggest commercialisation on the part of the public sector; they show an appreciation of the market-oriented strategy necessary for engaging in applied research. On the part of the private sector, PPPs perhaps point to the level of engagement of private companies in agricultural research. Where a private firm forms a partnership with a public research institution, it is assumed that the company already has some experience in the subject area of partnership. This could be upstream research or downstream development and distribution of technology. PPPs therefore serve as useful tools in that they are indicators of the level of private sector involvement.

Time series data on agricultural PPPs in the two countries is not available. There are however anecdotal indications that there are increasing partnerships between the public and private sectors. In Kenya, the Kenya Agricultural Research Institute (KARI) conducts some projects jointly with some universities and has numerous collaborative projects with the international agricultural research centres, donor organisations and the private sector. This is especially so in modern biotechnology projects.

As at December 2006, there were about 13 agricultural modern biotechnology projects in Kenya. These modern biotechnology projects have four interesting features: firstly, all are PPPs, secondly, all are North-South partnerships; thirdly, many involve multinational corporations and finally, and perhaps most telling, they are all in collaboration with KARI. This has helped ensure their relative progress; involving KARI (a government agency) ensures the government buys into the project and thus facilitates its progress.

2.3 Impact of privatisation & commercialisation on food security

The current spike in the prices of agricultural commodities and its pervasive global effect across sectors reminds us of the important and multiple roles that agriculture plays in the global economy. The world's population has increased dramatically in the past three decades while agricultural production has grown in the same period at a much slower pace: The world's population currently stands at 6.5 billion and is projected to rise to more than 9 billion by 2050. Although global food production

meets the needs of the world's population, the per capita food production and availability is lowest in developing countries, particularly those in Asia and Africa. Current estimates indicate that 852 million suffer from hunger; a vast majority of these—815 million—are in the developing world.

In Sub Saharan Africa, agricultural growth has remained constant at best with most countries registering a decline in food production; food security remains a paramount issue. The world's leaders and top development agencies galvanised efforts in the form of the UN Millennium Development Goals, the first of which is to eradicate extreme poverty and hunger. This is evidence that food security is a paramount concern not only to individual governments but also to the global community as a whole. The recent spikes in the cost of agricultural commodities globally showed that whereas food security in the past was predominantly a problem affecting developing countries, food security concerns are now at the forefront in the global agenda.

This section now turns its attention to the implications of increasing privatisation and commercialisation on food security. Collectively, it looks at the potential impact of three changes: the growing number of private sector companies engaging in agriculture, increasing private sector investment in agriculture and the increase in agricultural partnerships. The potential impact of IPRs on food security are analysed in the next chapter. As there are no conclusive studies linking these factors and food security, this analysis is accordingly theoretical and addresses these factors from a '*potential* impact' perspective.

2.3.1 Definitions, causes and solutions

The causes of global food insecurity are many and varied particularly in the developing world. The attempts at defining food security have been just as numerous and, to date, there is no universally accepted definition. Maxwell lists over thirty different definitions of food security used by various authors between 1975 and 1991.[50] Various definitions proffered include:

[50] Maxwell, S., Food security: a postmodern perspective, *Food policy* 21/2 (1996). See also Maxwell, S. & Smith, M., 'Household food security: a conceptual review' in Maxwell, S. & Frankenberger, T.,

- Access by all people at all times to enough food for an active, healthy life. Food security includes at a minimum: i) ready availability of nutritionally adequate and safe foods, and ii) an assured ability to acquire acceptable foods in socially acceptable ways[51]
- Physical and economic access, at all times, to sufficient, safe and nutritious food to meet dietary needs and food preferences for an active and healthy life[52]
- Access by all people at all times to enough food for an active, healthy life[53]
- The state in which all persons obtain a nutritionally adequate, culturally acceptable diet at all times through local non-emergency sources[54]
- When all people at all times have access to sufficient food to meet their dietary needs for a productive and healthy life[55]
- Condition of having enough food to provide adequate nutrition for a healthy and productive life[56]
- The availability of foodstuff in sufficient quantity at a global level[57]

The Food and Agriculture Organisation (FAO) in the 1996 World Food Summit attempted to remedy earlier deficiencies in the definition of food security. The ensuing definition was that:

> "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life."[58]

(eds.) *Household food security: concepts, indicators, measurements: a technical review.* (New York & Rome: UNICEF & IFAD,1992)

[51] USDA definition, available at http://www.worldhungeryear.org/fslc/faqs/ria_074.asp?section=14&click=9

[52] FAO glossary, available at http://www.fao.org/ag/wfe2005/glossary_en.htm

[53] World Bank, available at http://lnweb18.worldbank.org/ESSD/ardext.nsf/12ByDocName/KeyTopicsFoodSecurity

[54] Sustainable Agriculture Net glossary available at www.sustainableag.net/glossary_e-i.htm

[55] USAID, available at http://www.usaid.gov/our_work/agriculture/food_security.htm

[56] Future Harvest glossary available at http://www.futureharvest.org/about/glossary.shtml

[57] Scoones, I., 'Agricultural biotechnology and food security: exploring the debate' IDS Working Paper 145 (Brighton: Institute of Development Studies, 2002)

[58] FAO. Rome declaration on world food security and world food summit plan of action, World Food Summit, Rome 13-17 November (1996) available at http://www.fao.org/wfs/index_en.htm

The FAO definition was refined in The State of Food Insecurity 2001 to include *social* access to food.[59] This thesis uses this broad definition of food security.

Two observations can be made from the definitions in the above exercise. The first relates to the levels at which food insecurity can be analysed. The 1996 World Food Summit focuses on food security at the individual, household, national, regional and global levels. Such a classification has been used in analyses of the causes of food insecurity.[60] The second observation is that the food security definitions acknowledge the importance of not only availability of food but also effective access and distribution of the available food and the appropriate utilisation of the food. These three distinct factors—availability, access and utilisation—are important not in the least because they help in developing the indices for measuring and analysing food security.

The fairly recent focus on access and utilisation can be closely identified with Sen's seminal study where he challenged the then widely held conviction that lack of food supply (availability) was the primary cause of famine.[61] Sen avoided the adoption of the concept of food security for this reason, and instead focused on the entitlements of individuals and households. As access issues are entrenched in social, political and economic relations, Sen's work represented a clear shift in emphasis from natural to societal causes of food insecurity. The USAID Policy Determination defines food security and lists the causes of food insecurity through the three dimensions: availability, access and consumption.[62]

The causes of food security can be analysed at the micro (individuals and household) and macro (national, regional, international) levels. Cullet[63] distinguishes between food security at national and at individual levels. Using his classification, at the individual level, poverty and lack of income is the leading constraint to food security. This is evinced in the Millennium Development Goals which address eliminating

[59] FAO., *The state of food insecurity in the world* (Rome: FAO, 2005)
[60] For example, Cullet, P., 'Food security and intellectual property rights in developing countries' a study conducted under the Interdisciplinary Biosafety Network and UNCTAD/ICTSD Capacity building Project on IPRs and sustainable development (Geneva: RIBios, 2003)
[61] Sen, A., *Poverty and famines* (Oxford: Clarendon Press, 1981)
[62] USAID Policy Determination PD-19, 13 April (1992)
[63] Cullet (2003) *supra* note 60

poverty and hunger as one goal (and indeed the first goal). Poor people are least likely to have access to sufficient safe and nutritious food to meet their dietary needs and food preferences.[64] The Rome Declaration recognised poverty as a 'major cause of food insecurity and sustainable progress in poverty eradication is critical to improve access to food.'[65]

Shiva[66] asserts that a distinction between global and individual food insecurity cannot be maintained as the causes and influences of food insecurity at both levels are inextricably tied. Adopting a wider approach to causes of food insecurity, Shiva goes further than stating poverty as a cause of food insecurity and instead addresses the *causes of poverty* as the causes of food insecurity. She argues that the failure to place food security in a framework of rural-oriented economic growth, in combination with policies to stabilise domestic food economies are to blame. Shiva contends that this failure is a direct consequence of the current international trade regime characterised by corporate driven reforms.

Constraints to food availability include biotic and abiotic factors. This set of causes has been used to advocate for biotechnology as a tool for increasing productivity by adapting crops to the biotic and abiotic conditions. In advocating for biotechnology as part of the solution, Chaturvedi posits that the constraints on productivity have become more acute since the 1980s when the Green Revolution varieties reached their potential.[67]

Climatic change and natural disasters such as the Indian Ocean tsunami, earthquakes and the prevalence of armed conflict and wars lead to food crises. Inadequate rain and a locust invasion in 2004 lead to an 80% increase in grain prices and severe food shortage in Niger.[68] Although there is no conclusive evidence that climatic variability and occurrence of extreme events such as drought, flood or storms have increased

[64] See Persley, G. 'Agricultural biotechnology and the poor: promethean science' (1999) available at http://www/cgiar.org/biotech/rep0100/persley.pdf and DFID, Hunger factsheet (2005) available at www.dfid.gov.uk/pubs/files/mdg-factsheets/hungerfactsheet.pdf
[65] See http://www.fao.org/wfs/index_en.htm
[66] Shiva, V., Elections, agriculture and the budget, *BIJA* 33&34 (2004)
[67] Chaturvedi, S., Agricultural biotechnology and new trends in IPR regime: challenges before developing countries, *Economic and Political Weekly* 30 March (2002)
[68] FAO/WFP., *Special Report: FAO/WFP crop and food supply assessment mission to Niger* (Rome: FAO, 2004)

significantly, global models nevertheless suggest that such changes in climatic variability are likely to occur in the future.[69]

2.3.2 Increased private sector presence and food security

Increasing private sector presence in agriculture has potential positive effects on food security. Firstly and premised on the assumption that increased private investment in agriculture means that more resources are available for agriculture research, private investment in agriculture could help ease the financial burden in the public sector. Private companies typically invest in areas where they are likely to get financial returns e.g. commercial cash crops. This means that the public sector can roll back its activities in these areas and concentrate on other areas which are less attractive to the private sector e.g. orphan crops. This would in theory lead to more efficient use of funds as public investment including that from the conventional donor agencies can be targeted at food security related research particularly that which the private sector has no interest in conducting.

Increased private sector investment presents the public sector with an opportunity to relinquish some of its activities to the private sector and can facilitate the improvement of cost recovery and efficiency in the public sector's remaining research activities. There has, however, to be a healthy balance between public and private research particularly in fragile areas such as agriculture. Because of the private sector's profit-based motive, a private sector led agenda risks distorting research priorities which results in neglecting research in crops with low rates of profit returns. Evidence from various studies conducted on private sector investment in agriculture shows that the private sector investment is centred on commercial crops rather than food crops.[70] This makes the case for public sector led agriculture research particularly in developing countries with fragile food systems. Evidence from Kenya and India shows that although private sector investment in agriculture is growing at a faster rate than that from the public sector, the latter still plays the primal role in agriculture research.

[69] FAO., 'Trade reforms and food security: conceptualising the linkages' Experts consultation Rome 11-12 July (2002)
[70] Pinstrup-Andersen, P., Pandya-Lorch, R. & Rosegrant, M., *World food prospects: critical issues for the early twenty first century* (Washington DC: IFPRI, 1999)

Although increased private sector presence in agriculture presents the public sector with the opportunity to withdraw from areas covered by the private sector and hence avoid competition, a potential risk relates to the migration of agriculture research staff from the public to the private sector. Having been involved in agriculture research for longer, the public sector generally has more experienced staff than the private sector. The two sectors are in competition for this pool of experienced researchers. As the private sector is generally better financially equipped, the public sector risks losing staff to better paid jobs in the private sector. The erosion of public sector capacity has grave consequences on public agricultural research and its ability to address food insecurity.

Although the use of conventional breeding and the improvement of agricultural practices may have served some countries well in the past, biotechnology is increasingly being cited as offering the scope to resolve some of the agronomic problems affecting crop production in developing countries and hence improve food security.[71] Private sector presence in the agricultural sector has further increased with the advent of modern biotechnology.[72] IPRs have clearly contributed to the development of biotechnology by offering the prospect of private profit.

The use and application of agriculture biotechnology in developing countries raises various issues. Alongside global concerns for environmental and human safety, most developing countries lack the capacity and the supporting systems such as biosafety regulations under which biotechnology is applied. That apart, biotechnology is but a tool and does not contain all the answers to food insecurity. Analysing the possible impact of biotechnology on food security in developing countries, Spillane posits that biotech will benefit the poor farmers only if 'applied to well defined social and economic objectives.'[73] Cullet adds that application of biotechnology increases the

[71] Swaminathan, M., 'Genetic engineering and food security: ecological and livelihood issues' in Persley, G. & Lantin, M., (eds.) *Agricultural biotechnology and the poor: proceedings of an international conference, Washington DC. 21-22 October 1999* (Washington DC: CGIAR); Chaturvedi (2002) *supra* note 67

[72] OECD., 'Accessing agricultural biotechnology in emerging economies' framework papers from the OECD Global Forum on Knowledge Economy: Biotechnology, Paris, 18-19 November (2002)

[73] Spillane, C., 'Agricultural biotechnology and developing countries: proprietary knowledge and diffusion of benefits' in Swanson, T., (ed.) *Biotechnology, agriculture and the developing world: the distributional implications of technological change* (Cheltenham: Edward Elgar, 2002)

likelihood of specialisation and increase in commercial crops at the expense of food crops.[74] Biotechnology therefore has the potential to achieve food security or to distort agriculture research.

Cooperation with the private sector through partnerships and other forms of collaborations is generally viewed as positive. PPPs have the potential to increase the effectiveness and volume of total agriculture research efforts. The two case studies in this thesis are PPPs which have demonstrated the potential of partnerships in addressing food security. The success of PPPs and their ability to meet their food security objectives however depends on how they are administered. Poor regulation, governance and decision making processes can drain public resources. Cultural differences may also reduce the benefits and increase the costs of running the partnership. PPPs may also lead to partners engaging in rent seeking behaviour. Research institutions may also give preference to PPPs because of the additional budget involved at the expense of other research programmes.[75]

2.4 Conclusion

Private sector investment in agriculture is growing; in India, the seed industry is predominantly from the private sector with domestic as well as multinational seed companies. Investment in biotechnology has also increased leading to more private sector presence in both countries although in the case of Kenya, the private companies in agricultural biotechnology are virtually all foreign. Like India, private investment in agriculture in Kenya is concentrated in the seed and plant breeding industries. At best, agriculture R&D in the two countries is private sector-influenced rather than private sector-led. Agricultural research is still largely funded by the public sector in addition to, particularly in Kenya, donor agencies.

The role of IPRs in increasing private sector participation is uncertain. Theoretically, IPRs present the private sector with incentives to invest in research. In the two study countries, there is evidence that the private sector has opted for incentives provided by

[74] Cullet (2003) *supra* note 60
[75] See generally Van der Meer, K., 'Public-private cooperation in agriculture research: examples from the Netherlands' in Byerlee & Echeverria (2002) *supra* note 1

non-IPR mechanisms such as biological protection provided by hybrids. There is no conclusive evidence that IPRs increase private sector investment in agriculture although this is not to mean that they are unimportant. A more probable link between the two is that the private sector presence in agriculture increases the likelihood of the use of IPRs in agriculture research. This is supported by PBR and seed certification data from Kenya; most of the PBR applications are from the private sector.

Because the paramount goal of reduction of poverty and eradication of hunger (Millennium Development Goal 1) is inextricably woven into the fabric of the agriculture, there is general global consensus that governments in developing countries especially those worse hit by poverty and food insecurity have a paramount role in agriculture. The agricultural sector as a whole is embedded in an extended network of economic and political relations existing between various institutions and enterprises, markets as well as between sectors of the economy. Success in achieving the overarching goal of poverty reduction and attainment of food security crucially depends on the delicate balance between competing and diverse interests.

Chapter Three

Private rights and public goods: conflicts in food security oriented research

3.0 Introduction

The previous chapter illustrated inter alia that private sector presence in agriculture has increased in the last two decades in the study countries although the public sector is still the dominant player in the field of agriculture. The increasing private sector presence, the advent of the IPR system and the concomitant protection of research tools and other technologies are some of the developments influential in exposing public research organisations to IPRs.

Using the international agricultural research centres under the Consultative Group on International Agriculture Research (CGIAR or CG) as an example, this chapter examines whether the exposure to IPRs compromises the public goods mandate of international agricultural research centres (IARCs) in the CGIAR. Given the centrality of food security to the CGIAR's raison d'etre, it may reasonably be assumed that such compromise potentially has dire consequences for food security. The CGIAR is chosen as it is the largest public sector investor in agriculture in developing countries with a specific food security mandate.[1]

This enquiry into the interface between public goods and IPRs is based on the premise that IPRs as a concept are structured towards the attainment of private rights and are therefore more consonant with the private sector and its for-profit motivation.[2]

[1]The Consultative Group on International Agriculture Research is an alliance of public and private donors made up of countries, international and regional organisations and private foundations that support the network of fifteen mostly commodity based international agriculture research centres. The CGIAR's mission is to 'to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment.' See chapters 4 and 6 for more on the CGIAR.

[2] Mugabe, J., Intellectual property protection and traditional knowledge: an exploration of international policy discourse, paper prepared for WIPO (1998) available at http://www.acts.or.ke/paper%20-%20intellectual%20property.htm

Increasing concern about the application and management of IPRs by the public sector[3] provide further justification for analysing the compatibility of IPRs with the provision of public goods.

This chapter argues that there is an inherent theoretical conflict in the application of private rights for the provision of public goods given that IPRs introduce excludability to a good. But there is a distinction between the *existence* and *exercise* of IPRs. It is the latter rather than the former that determines the effect IPRs have on the provision of public goods. This chapter concerns itself with the existence of IPRs while the next will look at the exercise of IPRs.

This chapter is organised in six parts. The first section looks at the theory behind public and private goods. The second investigates whether agricultural research as conducted by the CG Centres yields public goods while the next looks at IPRs and the correction of market failure. The fourth examines the theoretical implications of using IPRs in the provision of public goods. The fifth section shows instances where public agricultural research institutions are exposed to IPRs, while the last section highlights some of the potential impacts that IPRs may have on food security.

3.1 Public goods and private goods: a theoretical perspective

The following section concerns itself with two questions: firstly, what determines whether a good is public or private and secondly, what determines what sector is best suited to provide a particular type of good. The ultimate goal is to determine what happens when pubic goods are provided through the use of private rights. Do they still remain public goods? A secondary question is whether the public sector is the generally most suited sector to provide public goods and if so, what happens when the exception pertains.

The interest in public goods can be traced back to classical economics perhaps beginning with the publication of Samuelson's seminal articles in the mid 1950s.[4]

[3] Maredia, M., Application of intellectual property rights in developing countries: implications for public policy and agricultural research institutes, paper submitted to the WIPO (2001) available at http://www.wipo.int/export/sites/www/about-ip/en/studies/pdf/study_k_maredia.pdf

Samuelson used the "jointness of consumption" as the main attribute to divide all goods into two classes: private consumption goods and public consumption goods. According to Samuelson, "collective consumption goods" are those goods '… which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good…'[5] Jointness of consumption is also referred to as nonrivalry, nonrivalry of consumption or indivisibility of benefits. Some authors do indeed use the terms interchangeably.[6]

Musgrave[7] on the other hand argued that a different attribute – whether someone can be excluded from benefiting once the good is produced (excludability) – was more important that Samuelson's rivalness attribute. Both aimed to show when market forces would perform optimally in the provision of specific classification of goods and when markets would fail.

Pure public goods are contrasted to private goods which are said to be rivalrous and excludable. Pure public goods are not diminished by use (non-rivalrous) and are freely available for all (non-excludable) so as to be accessible to growing numbers of people without any marginal cost. These qualities in their purest form are exemplified by knowledge. Jefferson observed in 1813 that 'He who receives an idea from me, receives instruction himself, without lessening mine; as he who lights his taper at mine receives light without darkening me.'[8] The effect of IPRs on knowledge is revisited later in the chapter.

According to Samuelson,[9] rivalrous goods, whether excludable or not could be efficiently provided through market mechanisms while Musgrave,[10] arguing that

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[4] Samuelson, P., The pure theory of public expenditure, R*eview of economics and statistics* 36/4 (1954) 387 and Samuelson, P., A diagrammatic exposition of a theory of public expenditure, *Review of economics and statistics* 37 (1955) 350

[5] Samuelson (1954) *supra* note 4 at p1

[6] Cornes, R. & Sandler, T., *The theory of externalities, public goods and club goods* (Oxford: Oxford University Press, 1996)

[7] Musgrave, R., *The theory of public finance* (New York: McGraw-Hill, 1959)

[8] Jefferson, T., *Thomas Jefferson, Writings* (New York: The Library of America, 1984); Powell similarly observed that 'The learning of one man does not subtract from the learning of another, as if there were a limited quantity to be divided into exclusive holdings… That which one man gains by discovery is a gain of other men. And these multiple gains become invested capital…) Powell as quoted in Dalyrmple, D. International agricultural research as a global public good: Concepts, the CGIAR experience, and policy issues, *J. Int. Dev.* 20 (2008) 347 at p350

[9] Samuelson (1954) *supra* note 4

excludability was the determining factor, contended that market mechanisms are preferable for those goods that are excludable whether rivalrous or not. Similarly, Cornes & Sandler[11] argue that nonexcludability is the crucial factor in determining which goods must be provided by the public sector. All agreed that the wide dispersion of benefits concomitant with pure public goods renders them unsuitable for private entrepreneurship and that these are therefore best provided for by the state.

Most of the economic explorations on the distinction between public and private goods are studies in allocative and distributive efficiency i.e. public finance; they aim at determining when government spending or intervention is necessary and when the market is best suited to provide for particular types of goods.

Examples of pure public goods have been dwindling since the critique of the classical examples of the lighthouse and of national defence. Classical economics literature such as Buchanan's *An economic theory of clubs*[12] further sparked economists' interest in the chasm between pure public goods and pure private goods.[13] The resulting rigorous explorations led to expansion of the list of goods that did not fit into either category. It is now widely acknowledged that goods rarely fall neatly within the above criteria hence the recognition of club goods and common pool resources.

Strictly speaking, most goods have shades of rivalry and excludability characteristics. Samuelson himself conceded that many goods commonly termed as public goods do not fit within his definition;[14] moreover, given that the world is finite, resources in it are finite too and the economic concept of scarcity applies ubiquitously so that public goods are not exempt. Strict non rivalry is therefore not possible. Similarly, Pickhardt

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[10] Musgrave (1959) *supra* note 7
[11] Cornes and sandler (1996) *supra* note 6
[12] Buchanan, M. An economic theory of clubs, *Economica*, 32 (1965) 1
[13] In examining the conditions under which individuals with a common interest organise and bear the cost of pursuing that interest, Olson's *Logic of collective action* alluded to the difficulty in strict categorisation of goods as either public or private. He showed that private organisations can also provide public goods e.g. the benefits from large organisations such as labour unions or lobbies automatically go to every individual in the group, whether or not he helped bear the costs
[14] Samuelson (1955) *supra* note 4

observes that most goods which give rise to private benefits also involve externalities in varying degrees thereby combining both public and private good characteristics. [15]

Drahos underscores this by stating that 'a public good is not a single good, but an effect with complex antecedents made up of a set of complementary goods (private and public) and different types of social actors.'[16] Examples of seemingly pure public goods that are in fact impure public goods include education, health, agriculture and the justice system where in practice, these are not consumed in equal amounts by everyone and one person's consumption decreases the amount available for other people to consume or at least reduces the quality of service available to others.[17]

Moving slightly away from the classification criteria as a determinant of whether a good is private or not, one might examine other perspectives such as those held by Goldin and by Holtermann. The former argues that the "publicness" of a good is not an inherent characteristic of the good itself but of the manner in which it is produced. For Goldin,[18] any good can be either a public or private good depending on the choice of production method. This view assumes that public goods are provided by the public sector and private goods by their counterpart, a notion that is refuted in most literature and later in this chapter.

Holtermann posits that it is the way that goods are made available and how they are utilised that makes them public or not. This perspective finds resonance with the theme of *exercise* pursued in the next chapter.

Holtermann[19] distinguishes between the availability and utilisation of a public good; its provision may be public in so far as it is equally available for everyone's consumption but its utilisation may contain aspects of private goods in that utilisation

[15] Pickhardt, M., Fifty years after Samuelson's "The pure theory of public expenditure": What are we left with?, paper presented at 'The 58th Congress of the International Institute of Public Finance (IIPF)' Helsinki, 26-29 August (2002)
[16] Drahos, P., 'The regulation of public goods' in Maskus, K. & Reichman, J., (eds.) *International public goods and transfer of technology under a globalised intellectual property regime* (Cambridge: Cambridge University Press, 2004)
[17] A phenomenon termed as 'congestion'; see Cornes and Sandler (1996) *supra* note 6
[18] Goldin, K. D., 'Equal access vs. selective access: a critique of public goods theory' in Cowen, T., (ed.) *The theory of market failure: a critical examination* (New Brunswick: Transaction Publishers, 1992)
[19] Holtermann, S., Externalities and public goods, *Economica*, 39/153 (1972) 78

is different for different individuals and an increase in one person's utilisation decreases the amount available to others. In determining if a good is a pure public good or a mixed good, Holtermann maintains that this will depend on whether an individual consumption unit can be defined and secondly, whether consumption is in the control of the consumer, at least in principle. He however concedes that the dividing line is not always clear.

The "privateness" or otherwise of goods is also not constant. Through technological, legal, institutional, policy and other interventions, a public good can be made private and vice versa. For example, technological advances in ICT such as digital rights management and encryption allow the media industry to exclude customers from cable and satellite TV reception from what was once a public good (non excludable and non rival) when radio and TV transmission first emerged. In agriculture biotechnology, the use of terminator technology constitutes a technological intervention intended to increase excludability. Vaknin argues that in the same way, technology converts some private goods into impure public goods: 'education used to be a private good with positive externalities. Thanks to technology and government [intervention] it is no longer the case. It is being transformed into a non pure public good.'[20] To the transformative nature of interventions, Kaul and Mendoza include policies and other social interventions: 'in many if not most cases, goods exist not in their original forms but as social constructs, largely determined by policies and other collective actions.'[21]

Given that the nature and externalities of goods can change over time, it is not possible to demarcate goods into strict categories of pure public and private goods. Most goods lie in the pure public goods – private goods continuum. In fact, it might be a misnomer to refer to it as a continuum as impure public goods differ from one another along more than one dimension: varying degrees of excludability and rivalry exist within the category of impure public goods. Cornes and Sandler caution that this

[20] Vaknin, S., 'Is education a public good' available at http://www.totse.com/en/politics/political_spew/iseducationapu173733.html at p3

[21] Kaul, I. & Mendoza, R., 'Advancing the concept of public goods' in Kaul, I., Conceicao, P., Le Goulven, K. & Mendoza, R., (eds.) *Providing global public goods: managing globalisation* (Oxford: Oxford University Press, 2003)

'spectrum is best viewed as a pedagogical device that provides a way of visualising the diverse kinds of goods.'[22]

From the foregoing, one can conclude that the characteristics of the good together with the way the good is made available and utilised, determine whether a good is public, private or otherwise. One must however bear in mind the transformative nature of interventions e.g. policies, technologies, etc. as these have the potential to transform a good from one type to another. The question of who provides the good is not a factor in determining whether a good is public or private; private research can produce impure public goods and vice versa.

The preceding was an attempt to look at the factors that determine whether a good is public or private. The following now turns to what determines what sector is best suited to provide a particular type of good. The context is necessarily agriculture.

3.2 Agriculture research as a public good

Emerging literature on global public goods can be used to shed light on agriculture research as a public good. The enquiry of whether agriculture is a public good is held within the wider context of what sector is best suited to provide public goods accruing from agriculture; it is premised on the fact already established in the preceding section that very few goods are truly purely public goods.

The social returns to research investment even when conducted by the private sector possess some degree of public goods characteristics. Indeed Nelson,[23] Arrow[24] and others[25] argued that social returns from private research investment exceed private returns. Research conducted by the public and private sectors (and by the two in

[22] Cornes and Sandler (1996) *supra* note 6 at p9
[23] Nelson, R. The simple economics of basic scientific research *Journal of Political Economy* 67 (1959) 297
[24] Arrow, K., 'Economic welfare and the allocation of resources for invention' in *The rate and direction of inventive activity: Economic and social factors* (Princeton: Princeton University Press, 1962)
[25] Mansfield E., Rapoport J., Romeo A., Wagner S. & Beardsley G., Social and private rates of returns from industrial innovations, *The Quarterly Journal of Economics* 91 (1977) 233; Ruttan V., Technology, growth, and development: an induced innovation perspective (Oxford: Oxford University Press, 2001)

collaboration) is likely to produce public goods. It follows therefore that public benefits from research may therefore accrue not just from public investment but from private investment as well. The inverse is also probable.

The non rivalry and non excludability of pure public goods and some impure public goods renders them unsuitable for private production; the risk of 'free riding' results in under production of goods by the private sector. In such cases, the public sector should step in to ensure that the socially desired level of production and consumption is achieved. This however does not mean that the public sector must be primarily engaged in the production of public goods; these can be subcontracted to the private sector where this is thought to be cost effective. David puts it succinctly: 'The term "public good" does not imply that such commodities cannot be privately supplied, nor does it mean that the government must produce it.'[26]

The public sector has been known to engage in production of private goods such as where the public sector itself is contracted by the private sector; examples in agriculture include conducting soil tests for private breeders and sub letting premises and equipment for small private companies to conduct research. This is becoming more common with the growing practice of diversification of services and income within public research institutions.

Gardner and Lesser[27] apply the global public goods concept in assessing the most promising activities for donor support of international agriculture research. They argue that public agriculture research as conducted by the CGIAR centres produces impure rather than pure public goods because not all of the goods and services produced from the centres' research is available to all people; the existence of excludability means the goods and services produced are impure public goods: 'However, much agricultural research does not produce Samuelsonian public goods, much less global ones. The typical case is that *some* users cannot be excluded or charged for *some* uses of the goods or services produced. Agricultural research thus

[26] David, P. 'The political economy of public science' in Smith, H., (ed.) *The public regulation of science and technology* (New York: Palgrave, 2002) at p36
[27] Gardner, B. & Lesser, W. (2003) International agricultural research as a global public good, *Amer. J. Agr. Econ.* 85/3 (2003) 692

produces "impure" public goods. Equivalently, it can be said that agricultural research generates spillovers or exernal benefits…'[28]

Adopting a similar argument, Dalrymple[29] posits that because agriculture research is usually limited to a commodity or sector, its outputs are by definition excludable to other commodities or sectors and are hence impure rather than pure public goods. But the classical economic concept of excludability as discussed in the preceding section relates to excludability of individuals rather than of commodities or sectors; the latter cannot be used as units of analysis to test excludability. Agriculture research is an impure public good but Dalrymple's reason, according to classical economic theory, does not make it so.

In countering Dalrymple's argument, Ryan falls victim to the same trap. Using biotechnology as an example, Ryan argues that higher end biotechnology cuts through sectors and breaks down 'interspecific biological barriers': 'Especially at the basic/strategic end of the spectrum, such boundaries hence would not seem to constrain the public good ambit *per se*.'[30] He seems to suggest that the more potential a good has for research spillover (such as basic biotechnology which can be applied across various sectors), the more it moves towards being a pure public good. Like Dalrymple, Ryan bases his analysis of whether a good is purely public on the applicability of the good across sectors rather than the inclusivess (or rather nonexcludability) of the good or service relative to users. Later, Dalrymple[31] argues that particularly due to its interaction with private research, public agricultural research is increasingly providing impure public goods rather than pure public goods. This seems to suggest that private research 'dilutes' the public nature of goods.

[28] Id at p693

[29] Dalrymple, D., Scientific knowledge as a public good: thinking about benefits of research to society could break down barriers, *The Scientist* 19/2 (2005) 10; see also Dalrymple, D., Impure public goods and agricultural research: toward a blend of theory and practice, *Quarterly Journal of International Agriculture* 45/1 (2006) 71

[30] Ryan, J., 'International public goods and the CGIAR niche in the R for D continuum: operationalising concepts' in CGIAR Science Council *Positioning the CGIAR in the Research for Development Continuum* (Rome: Science Council Secretariat, 2006) at p3

[31] Dalrymple, D., International agricultural research as a global public good: concepts, the CGIAR experience and policy issues, *J. Int. Dev.* 20 (2008) 347

Even in its simplest form, agriculture research is no doubt an impure public good as it contains elements of both pure public and private goods. The ultimate end product of agriculture – food – is a private good in so far as it is both rivalrous (once consumed, it no longer exists) and excludable (the owner can exclude others from consuming it). The basic rationale of most agriculture research programmes particularly those in developing countries and certainly those in the CGIAR centres is the attainment of food security where all people have access to sufficient safe and nutritious food to meet their dietary needs for an active and healthy life. This in itself constitutes among other things, the provision of food (private good) although the spillovers or benefits of a healthy well fed nation impact on society as a whole (public good). Similarly the knowledge required in growing agronomically appropriate crops of high quality and yield is non-rivalrous and generally non-excludable (pure public good) although the application of that knowledge (embodied in the resulting technology) is potentially exclusive (impure public good).

The foregoing highlights the difficulty in clearly demarcating goods into pure public and private goods and makes the case that public goods can be produced by any sector and that agriculture research yields impure rather than pure goods. Impure public goods such as agricultural research can therefore be produced by the public sector, the private sector, a combination of the two or indeed other sectors.

3.3 IPRs and the correction of market failure

In an ideal market, the price of each good should be equal to the cost borne by society in consuming it. If goods are produced above marginal cost, they will be under-consumed; if they are provided at marginal cost (free) they will tend to be under-produced as there will be no incentive to invest in their production. Sometimes when the private sector engages in the production of impure public goods, the incomplete rivalry or excludability may yield in externalities thereby making their net marginal benefit lower to the producers than to society. This may render the private provision of various goods unprofitable in spite of their social profitability. Consequently, there can be under provision or no provision at all. Different mechanisms are used to correct this market failure; IPRs and government intervention are but two ways.

The utilitarian theory on IPRs is premised on incentives and rewards: that creators are encouraged to invent by the promise of a reward in the form of monopoly rights over their creation for a limited amount of time. The economic justification for IP lies not in rewarding creators for their labour but in assuring that they have appropriate incentives to engage in creative activities thereby addressing the question of under production. Ironically, IPRs themselves can cause market failure where they limit the diffusion of ideas and therefore prevent many people from benefiting from them. In this sense, the exercise of IPRs can result in under-consumption such as when IPRs result in vital drugs being prohibitively expensive so as to be out of reach of poor people. Moreover, it can be argued that IPRs seem to run counter to free market competition where they limit the availability of competitors to copy or otherwise imitate the intellectual efforts of the first person to develop an idea. These rights enable the IP holders to charge monopoly prices or to otherwise limit competition.

Because IPRs impose social costs on the public, IP laws can be justified by the public goods argument only to the extent that they do on balance encourage creation and dissemination of new works to offset those costs. A reason why IPRs are limited in time, scope, and effect is precisely in order to balance these costs and benefits. In applying a utilitarian model, the economic incentive benefits of IPRs must be balanced against the costs of limiting diffusion of knowledge. A critical issue in assessing the need for IP protection is whether innovators have sufficient means to appropriate an adequate return on investment in R&D.

Summarised therefore, the problem of knowledge embedded in technology is an example of a familiar problem of the supply of public goods: if sold at a price above marginal cost it will be under-consumed, if provided at marginal cost (usually free) it will tend to be under-produced unless there is some intervention to create an incentive. IPRs are one such intervention.

IPRs are a form of state subsidy to those engaged in the creation of knowledge. Government intervention through IPRs (subsidising inventors) improves social welfare only if the cost of distortion created by IPRs is less than the social welfare gain of the additional innovation that IPRs stimulate. Moreover, IPRs are often seen

as macro economic tools with a long term effect on economies. 'IPRs generate monopoly positions that reduce current consumer welfare in return for providing adequate payoffs to innovation, which then raises future consumer welfare.'[32]

A distinction can be made between the exercise of property rights in relation to rival goods on one hand and in relation to non-rival goods on the other. Economists have long argued that strong property rights applied to rival goods result in efficient outcomes and therefore increased social gain. But IPRs for non rival goods involve a trade-off. As seen earlier, non-rival goods by definition can be used by many people at the same time. Creators of such goods must either not care about profit (being motivated by other incentives) or the good will not be produced. In other words, when IPRs are applied to non-rival goods, the benefits derived do not cover the costs borne by society.

IPRs are but one way of addressing the potential under-provision problem related to supply of impure public goods. There are alternative ways of creating incentives;[33] Gallini and Scotchmer[34] provide a useful review of the literature on alternative incentive mechanisms drawing from Wright's analysis on how asymmetric information informs the choice of incentive mechanisms.[35] Different interventions have different distributional implications, welfare impacts and influence the nature of research and development differently.

IPRs may lead to the pricing of important welfare goods e.g. crops protected by plant variety rights out of poor people's reach. Application of IPRs may also distort

[32] Maskus, K. *Intellectual property rights in the global economy* (Washington DC: Institute for International Economics, 2000) at p32

[33] Such as Advance Market Commitments (AMCs), voluntary buy-out of patents, compulsory purchase of patents, state prizes for inventions, government funding of research and development and value-added services. Interestingly, the discourse on IPR and its relationship with development is beginning to look at these 'new alternative' interventions of rewarding/creating incentives for inventors. This perspective underpins initiatives such as the WIPO Development Agenda and the WHO Global Strategy and Action Plan on Public Health, Innovation and Intellectual Property which proposes to detach incentives from the price of drugs so as to make medicines more accessible to the poor. See for example Kremer, M. Creating markets for new vaccines, Part I: Rationale, *Innovation Policy and the Economy* 1 (2000) p35-72. Other ideas currently being tried out in the health sector include priority voucher schemes.

[34] Gallini, N. & Scotchmer, S. Intellectual property: when is it the best incentive system? *Innovation Policy and the Economy* 2 (2002) p51-77

[35] Wright, D. The economics of invention incentives: patents, prizes and research contracts, *American Economic Association* 73/4 (1983) p691-707

research priorities such as when private companies choose to invest in commercial crops and neglect pro-poor 'orphan' crops. This is especially important given that six companies hold 75 percent of all agricultural patents,[36] increasing the risk of non-delivery of agricultural inventions to the poor.

Even Adam Smith, the most ardent advocate of *laissez-faire*, recognised the need for government intervention in some select areas. This is needed in health, education and agriculture to reverse market failure, reduce transaction costs so as to enhance consumption or supply and hence positive externalities. Government intervention is needed to (re)direct research according to social value so as to promote creation of knowledge in areas with highest social return rather than according to the highest opportunity for rent extraction. This is particularly important given that the potential distributional impact of IPRs, social welfare costs and distortion of R&D are greater now than ever before as is the growing disparity in wealth allocation exacerbated by changes brought about by globalisation. Research into problems affecting the poor is increasingly marginalised over the development of technology for which rich consumers are willing to pay.

3.4 The implications of applying IPRs in the provision of public goods

It has been asserted that IP law is modelled on private gains and is therefore more compatible with private sector research.[37] This section explores the implications of applying IPRs in the provision of public goods; it builds on two arguments earlier mentioned. One, the Holtermann perspective that it is the way goods are made available and how they are utilised that makes them public or not and two, the distinction between knowledge and technology is vital in understanding the effect IPRs have on public goods.[38]

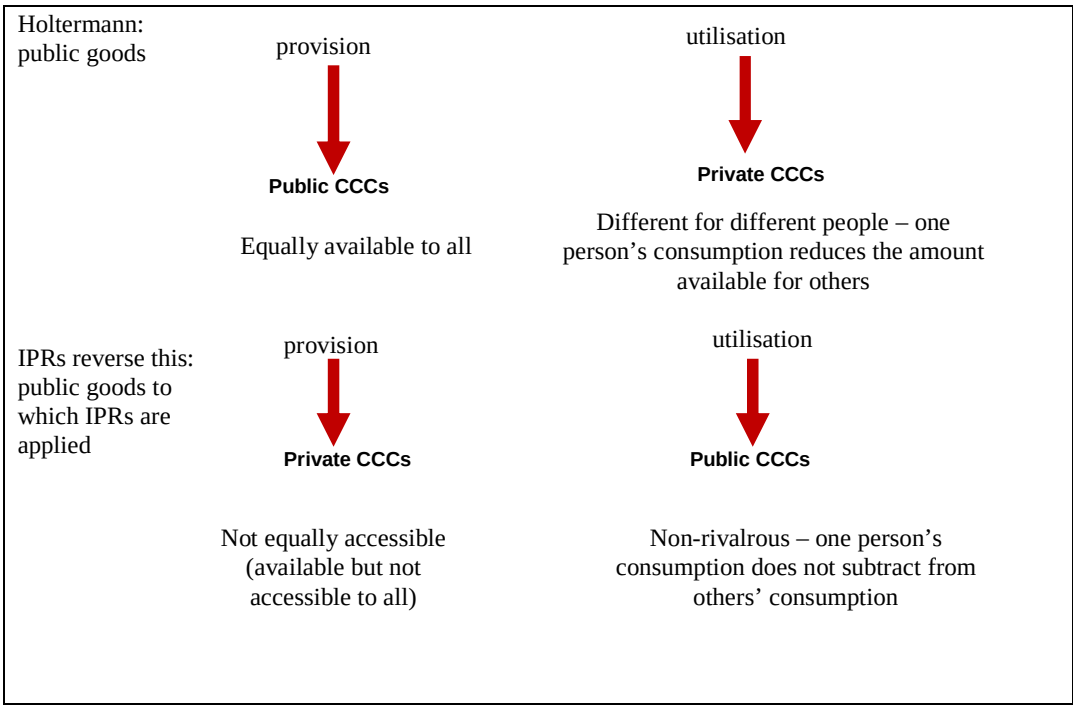
[36] Philips, R., Chen, J., Okediji, R. & Burk, D., Intellectual property rights and the public good: Universities have obligations to developing countries, *The Scientist* 18/14 (2004) 8

[37] Mugabe, J., Intellectual property protection and traditional knowledge: an exploration of international policy discourse, paper presented at the WIPO/UN Commission for Human Rights Roundtable (1999)

[38] Holtermann (1972) *supra* note 19

While arguing that the main determinant of whether a good is public or private is the manner in which it is made available and how the good is utilised, Holtermann distinguishes between the provision and utilisation of goods. To recap, he posits that provision of impure public goods has public characteristics in that the goods are equally available to all (non-excludable). Utilisation on the other hand has private characteristics: one person's consumption reduces the amount available for others' consumption e.g. hospital beds in health care, access to justice in the court system, etc.

Figure 3.1: The effect of applying IPRs to public goods using Holtermann's classification



IPRs can be said to reverse Holtermann's classification; firstly, public goods to which IPRs have been applied acquire private good characteristics i.e. the goods may be available to all but are only accessible to those who can pay the added royalty costs (assuming these are present). Secondly, where IPRs are applied to pure public goods, excludability in the provision of the goods concerned is traded off against non rivalry in the utilisation of the knowledge: the knowledge can be copied endlessly without being diminished and one person's consumption does not subtract from others' consumption.

Knowledge in its purest form is a pure public good in that it is nonrival, nonexcludable and has positive externalities. If technology is seen as the application of knowledge, IPRs may be said to alter the nature of technology from public to private by introducing excludability although not rivalry. For example, by imposing license fees and royalties to the final product, those who cannot meet the increased cost are excluded from using the product (excludability). The knowledge inherent in the technology is however not diminished by use (non rival). In fact, it may be argued that the disclosure requirement in the case of patents places more information relating to the technology (the application of the knowledge) in the public domain. This however has little bearing on excludability and non-rivalry because although more information is available to the public, a third party is still excluded from applying the knowledge during the life of the patent in the way described without authorisation from the right holder.

Dalrymple makes a similar distinction between science and technology and argues that 'science, as a form of knowledge, is more likely to inherently be a [public good] than is technology, which involves adaptation to particular circumstances and needs.'[39] He argues further that even knowledge itself is not spared from excludability:

> 'But as pure knowledge is drawn on, often through applied research, and becomes embedded in a particular technique or product, it usually looses some of its pure public good characteristics and becomes, to a varying degree, an impure public good. This is particularly true if the private sector is involved and some sort of intellectual property protection is exercised. While the most common result is that the embedded form of knowledge is not freely available to all (excludability), it becomes of greater value or use to individuals or society as a whole.'[40]

The main objective of public research organisations is presumed to be the provision of research products for the general public. Most public research organisations will particularly focus on research affecting the marginalized sections of the public. The

[39] Dalrymple (2008) *supra* note 31 at p354
[40] Id at p351

assumption is that the products of their research are equally available and accessible to everyone.

In theory therefore, there is an innate conflict in the application of IPRs to the provision of public goods. How does a public research organisation apply IPRs (which introduce excludability) while still maintaining their mandate to provide goods equally available and accessible to all? This inherent theoretical conflict has been the subject of many a debate; public research organisations have had various reactions to this conflict between the philosophy of public research and the existence of IPRs.

Having established that there is an inherent theoretical conflict in the application of IPRs to the provision of public goods, it has to be asked why public research organisations are faced with this dilemma. Why apply IPRs at all?

3.5 Why and when are public agricultural research organisations exposed to IPRs?

Trends in the last two decades are responsible for the exposure of public research organisations to IPRs. These include but are not limited to: a decline in public research funds and the pressure to generate income, the privatisation of research and the advent of the IP system.

The past decade has seen a constant decline in funds allocated for research in agriculture. In the face of many competing claims on donor aid, international agricultural research no longer commands priority in funding.[41] Donor aid to IARCs increasingly hinges on the impact of institutions' research. One effect of this is the trend from basic to applied research and the subsequent involvement of other partners, including the private sector, in downstream product development. Another effect of public research budget austerity is the increasing pressure on IARCs to commercialise their products to supplement their income. Although income generation is hardly the main factor motivating patenting (or other form of IP protection) of research in

[41] Blakeney, M., 'Agricultural research: intellectual property and the CGIAR system' in Drahos, P. & Mayne, R., (eds.), *Global intellectual property rights: knowledge, access and development* (Hampshire: Pelgrave Macmillan, 2002)

IARCs, the reality is that IP protection has the potential to generate income for IARCs.

The changing agricultural R&D scene has raised vital issues which IARCs and other public research organisations have to address. Not the least of these is the question of whether income generation is consistent with the wider mandate of public research organisations to serve the needs of the poor farmers and maximise benefits to society as a whole.[42] Public research organisations face the challenge of balancing the need for income generation and that of the delivery of public goods.

There is perhaps no greater factor that has contributed more in exposing public research organisations to IPRs than the privatisation of research. Globalisation of R&D and the growing assertion of ownership of agricultural resources through the application of IPRs by both the private and the public sectors characterise the environment under which IARCs and other public research organisations currently operate.

In the fields of agriculture and health, partnerships between the public and the private sector enjoy remarkable acclaim and are currently hailed as crucial strategies for the delivery of global public goods in the respective fields. PPPs are viewed as important institutional mechanisms that have immense potential to address complex development issues such as food security through the exploitation of synergies existing in the two sectors. In some of these instances, the use of IPRs by public research institutes may be key in achieving the goal of promoting access. This is particularly true where private sector partners are required for say, the development, manufacture and or distribution of public research. In international agricultural research for example, it is commonplace for IARCs to partner with seed companies for the multiplication and distribution of seed.

In product development partnerships, IPRs facilitate the engagement of the private sector by providing crucial bargaining chips. IPRs are sometimes used to segment the

[42] Fischer, K & Byerlee, D., 'Managing intellectual property and income generation in public research organisations' in Byerlee, D. & Echeverría, R., (eds.) *Agricultural research policy in an era of privatisation* (Oxon: CABI Publishing, 2002)

market thereby enabling the achievement of public goods goal particularly in developing countries. For example, IPRs to a technology may be traded off for contractual obligations to deliver the product to developing countries at a reasonable price, i.e. the developed markets can be traded for control of sales in developing markets so as to ensure that demand in the latter is met. An example in health is research in malaria where the 'paying market' is low, the research partners may trade any other disease use for control of the IP for the neglected disease; the commercial partners may acquire the rights to the foreground IP pertaining to all other diseases save for the pro-poor disease the partnership addresses.

Although it is generally argued that patenting research tools inhibits further research and thereby limits innovation,[43] Boettiger and Chi-ham[44] argue that where access to complementary enabling technologies necessary to produce a product is blocked, an institution with a patent on one of the research tools required has more leverage than one that does not. They argue that 'if an IP manager chooses not to patent an enabling technology... the ability to control its applications is lost.'[45] Control of research products and tools then becomes a reason to seek IPRs. Policy questions of whether research tools *should* be patented aside, the reality is that public research organisations are more likely to patent enabling technologies now than they were in the past.

The same applies to subsequent improvement patents. Contrasting an IP manager who chooses not to patent a technology to one who does, Boettiger & Chi-ham posit that in the former case, 'improvements to the technology are subsequently invented and patented, restricting the uses of the original technology'. In the latter, 'the value of the subsequent improvement patent would depend on access to the underlying dominant patent.'[46] These examples demonstrate the 'reactionary' nature that some public

[43] E.g. Wright, B. & Pardey, P., Changing intellectual property regimes: implications for developing country agriculture, *Int. J. Technology and Globalisation*. 2 (2006) 93; Clift, C., 'Patenting and licensing research tools' in Krattiger, A. *et al.* (eds.) *Intellectual property management in health and agricultural innovation: a handbook of best practices* (Oxford: MIHR & Davis: PIPRA, 2007)
[44] Boettiger, S, & Chi-Ham, C., 'Defensive publishing and the public domain' in Krattiger *et al.* (2007) *supra* note 43
[45] Id at p38
[46] Id

research institutes adopt in the current environment characterised by increasing privatisation of research.

Legal developments in some countries have transformed the public research environment and catalysed the public sector's engagement with IPRs. A ready example is the United States' Bayh-Doyle Act of 1980 which altered the incentives for federally funded universities to patent their research and license it to the private sector in line with 'translational research' objectives. University-industry partnerships and collaborations in the US increased dramatically as did university patents following the implementation of the Act.

Funding agreements with donors have similarly been known to expose public research institutes to IPRs by containing IP related clauses. It is not uncommon for funding agencies, particularly in product development public-private partnerships (PPPs), to reserve the right to retain control of the IP especially in late stage product development. This is often a safety net strategy to ensure production of the relevant technology in the event that a private sector partner forestalls the development of the designated product.

The advent of the IP regime has had a significant impact on the international agricultural research conducted for example by the CG Centres. One of the ways in which this has occurred relates to the risk of seeking IP protection for CG germplasm by third parties. A number of high-profile cases occurring in the late 1990s bear evidence to this. In 1998, PBR applications were made in Australia for accessions obtained from two CG Centres.[47] Research by the Action Group on Erosion, Technology and Concentration (the ETC group, then known as the Rural Advancement Foundation International, RAFI) indicates that there could be more cases of this nature.[48] In developing countries, it is likely that such abuse of CG germplasm is carried out not only by the private sector in the form of the numerous small seed companies, but also by partners in National Agriculture Research Institutes (NARIs) in spite of the Material Transfer Agreements (MTAs) that are used to

[47] Edwards, R. & Anderson, I., Seeds of wrath, *New Scientist* 14/2121 (1998)
[48] See the then RAFI press release, 1998 at http://www.biotech-info.net/moratorium.html

transfer CG germplasm to third parties probably due to ignorance and lack of IP capacity in both parties.

Protecting technology has in some cases attracted the involvement of the private sector. In some of the collaborations with the private sector, the probability of developing proprietary technology with significant commercial implications cannot be ruled out as an important incentive for the private sector. In other cases, private seed companies, recognising the competitively high quality of plant genetic material bred by the CG Centres, have been reluctant to distribute seed from the centres unless they can do so exclusively.

Similarly, dealings with the private sector have heightened the need for public research institutions to be IP savvy not in the least because of the danger of infringing IP belonging to a third party and the requirement to obtain freedom to operate. In other instances, IARCs use IPRs in order to ensure their technology is in the public domain. This is in accordance with the typical public research organisations' IP policy objective.

3.6 Alternatives to using IPRs

With regard to income generation, although the sale of IP protected research products can be beneficial in funding research costs, there is little formal analysis of the significance of the gains from using IP protection as a strategy for generating new revenues for research.[49] IARCs and other public research organisations can employ a number of ways to generate income to offset their budget deficit. Sale of non-research products and services such as soil and chemical testing, diagnostic tests, sale of commercial seed and vaccines and staff consultancies[50] are income generating activities that are generally within the mandate of public research organisations.

The preceding concedes that there are occasions where public research organisations have to apply or at least deal with IPRs. Clear guidelines have to be made and followed to ensure that pursuit of mandate is primal. These are only a snapshot of the

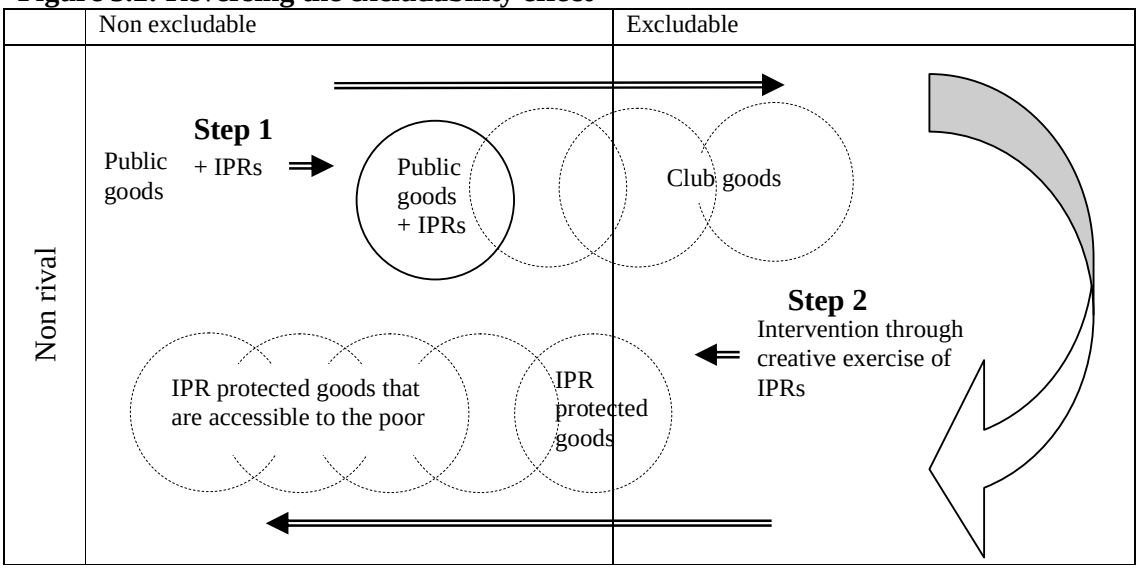
[49] Maredia (2001) *supra* note 3
[50] Id

IP challenges that CG Centres have to address in the context of research, commercialisation and protection of their products.

This section shows that there are only a few situations where IARCs' exposure to IPRs is avoidable. For those situations where it is inevitable that IARCs and other public agriculture research institutions engage with IPRs, the challenge is to apply IPRs in a manner that mitigates IPR's excludability effect thereby ensuring that the institution's food security oriented mandate is not compromised.

The scepticism of using IPRs in public agriculture research institutions including IARCs is rooted in the inherent theoretical conflict between IPRs and public goods as discussed in the preceding sections. The key lies in employing interventions, mainly through policy in the case of IARCs, that ensure goods to which IPRs have been applied remain in the public domain and accessible to particularly the poor communities the IARCs serve.

Figure 3.2: Reversing the excludability effect



The figure above uses knowledge as an example of a public good. In step 1, IPRs are applied to knowledge (nonrival, nonexcludable). This theoretically moves the goods (knowledge) from the public goods realm into the club goods (according to the Samuelson/Musgrave classification) as IPRs embed excludability, but not rivalry, into the goods; the knowledge does not diminish on repeated usage. For IARCs whose

mandate is premised on maintaining its products in the public domain and in a manner than makes the products accessible to the public, step 2 is vital. This entails the *creative exercise* of IPRs which ensures the move of the protected goods from the club goods category back to the nonexcludable, nonrivalrous public goods category.

Chapter four specifically looks at how IARCs can creatively exercise IPRs in order to mitigate the excludability effect and hence ensure their IPR protected technologies are in line with their public goods mandate.

3.7 IPRs and the centrality of food security

In agriculture, excludability through the imposition of royalties and licence fees to protected agriculture products is not the only *potential* impact IPRs have on food security.[51] The causes of food insecurity are varied and numerous. Attempts at defining food security acknowledge the importance of not only availability of food but also effective access and distribution of the available food and its appropriate utilisation.[52] These three distinct factors —availability, access and utilisation— provide useful starting points in analysing the potential impact of IPRs on food security.

The potential impacts of IPRs on food security mainly relate to the availability and access aspects. In the former, the issue is how IPRs affect the availability of food. This mainly relates to the incentives IPRs offer to food security oriented research. Regarding access to food, the role of IPRs mainly relates to economic factors such as the cost of seed. Some writers argue that at the individual and household level, it is this access aspect of food security that is most vulnerable to IPRs.[53]

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[51] "*Potential*" is emphasised as it is the way IPRs are exercised that determines the nature of the impact they have on food security. This is examined in detail in the next chapter.

[52] The World Food Summit definition is used: "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" FAO. Rome Declaration on World Food Security and World Food Summit Plan of Action. World Food Summit 13-17 November 1996, Rome, available at http://www.fao.org/wfs/index_en.htm

[53] Shiva argues that the causes of poverty are synonymous to the causes of food insecurity. She argues that the failure to place food security in a framework of rural-oriented economic growth, in combination with policies to stabilise domestic food economies are to blame and contends that this failure is a direct consequence of the current international trade regime characterised by corporate

Theoretically, by providing the possibility of appropriation of private profits, the IP system is an incentive for the private sector to play a part in predominantly public sector dominated agriculture research. As discussed in the previous chapter, this only has a potential positive effect on agriculture and food security if (i) it actually leads to increased private investment and (ii) if it is balanced against the public needs so that increased private sector presence does not distort research priorities to the detriment of food security attainment efforts.

The impact of IPRs on plant breeding, the seed industry and on biotechnology is premised on the provision of incentives and has a direct effect on the availability aspect of food security. In plant breeding, there is an expectation that IPRs offer incentives for the commercial exploitation of open pollinated varieties, diversifying away from exclusive reliance on hybrids and their built-in 'biological' protection. There is evidence in the two study countries that the commercial seed industry places value on hybrids despite lack of legal protection. The link between IPRs and increased investment in agriculture is tenuous in the Kenya and India.[54]

Discussions on the impact of IPRs on food security centre mainly on the access aspect. Concerns have been expressed over the potential impact of IPRs on traditional knowledge and the control and access to protected plant genetic resources by the resource poor in developing countries.

The introduction of IPRs in agriculture raises concerns with regard to farmers' control over their resources and knowledge. PBRs could potentially place restriction on the free exchange of germplasm and knowledge that has characterised farming communities in developing countries for many generations. Rural farming communities in developing countries still trade and exchange seeds locally. The origin

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driven reforms to which IPRs are co-related. See Shiva, V., Elections, agriculture and the budget, *BIJA* 33&34 (2004)

[54] See Louwaars, N., Tripp, R., Eaton, D., Henson-Apollonio, V., Hu, R., Mendoza, M., Muhhuku, F., Pal, S. & Wekundah, J., *Impacts of strengthened intellectual property rights regimes on the plant breeding industry in developing countries: a synthesis of five case studies* (Wageningen: Centre for Genetic Resources, 2005) and also Gerpacio, R., The roles of public sector versus private sector in R&D and technology generation: the case of maize in Asia, *Agricultural Economics* 29/3 (2003) 319; see section 2.2.2.3 in chapter two above.

of many plant varieties can be traced to such exchange and selection.[55] Practices such as on-farm experimentation and conservation 'form the basis of food security and livelihoods of communities throughout the developing world.'[56]

Other concerns relate to the potential increase in the cost of seed used by subsistence farmers. These form the bulk of the farming community in Kenya and India. The justification behind the introduction of PBRs is similar to that of patents: to act as an incentive encouraging plant breeding and to enable plant breeders recoup the costs of their activities by the collection of royalties. The imposition of royalties on protected seed, alongside the restriction on farmers to save and re-use seed, impacts directly on access to seed by farmers. As earlier seen, access to food is a major component of food security and therefore anything that increases the costs of seeds is a direct constraint to achieving food security. As discussed further in chapter five, the impact of IPRs on the cost of seed and the farming practices in Kenya and India is yet to be seen.

In biotechnology, a major concern particularly in the public research community is that IPRs may stifle innovation rather than promote it through the use of broad claims on proprietary technology.[57] Broad claims are favourable to the right holders but inhibit research by others. Public research institutions, particularly those working in developing countries, such as the CG Centres have to be IP savvy to ensure that they do not infringe IPRs belonging to third parties.[58]

This risk has made international agriculture research centres wary of using technologies patented in donor countries in developing countries.[59] Research organisations have to negotiate Freedom To Operate (FTO) agreements with right

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[55] Downes, D., How intellectual property could be a tool to protect traditional knowledge, *Colum. J. Envtl. L.* 25/253 (2000)
[56] UNDP., *Making global trade work for people* (New York: UNDP, 2003)
[57] Barton, J. & Berger, P., Patenting agriculture, *Issues in Science and Technology Online* 17 (2001) 47 available at http://www.issues.org/17.4/barton.htm
[58] See Wolson, R., Intellectual property tools, innovation and commercialisation of R&D: Options to assist developing countries in positioning themselves to reap the benefits of a stronger intellectual property regime, with special reference to the role of intellectual property management in research organisations, paper presented at 'The ICTSD/UNCTAD/TIPS Regional Dialogue on Intellectual Property Rights, Innovation and Sustainable Development in Eastern and Southern Africa' South Africa, 29 June - 1July (2004)
[59] Barton & Berger (2001) *supra* note 57

holders to ensure that the former do not infringe on the rights of the latter. This increases the costs of research and with the prevailing low levels of public funds, this cost may be passed on to the public. The public research institution may also be discouraged by the high costs of negotiating over protected enabling technology and other research tools; this may inhibit crucial research with potential to contribute to the attainment of food security.

Generally, a plant variety must be new, distinct, uniform and stable to qualify for PBRs. It has been argued that PBRs could potentially lead to replacement of diverse seed varieties adapted for local conditions, usually by local farmers, with genetically uniform modern varieties promoted by commercial seed companies.[60] The homogeneity of crops is in part to blame for the lack of crops' resistance to pest and diseases.[61] PBRs could also potentially undermine food security in developing countries by promoting cultivation of a narrow range of genetically uniform crops, usually non-food cash crops,[62] at the expense of food crops which are often the crux of food security in developing countries.

3.8 Conclusion

'Publicness' and 'privateness' in a good are not innate properties – goods move along the public good – private good continuum and can be provided by any sector. Agricultural research is an impure public good and as it yields goods with both public and private good characteristics.

IPRs introduce excludability to public goods. There is an inherent theoretical conflict in the application of IPRs to public goods. Public research institutions such as the CG Centres increasingly find themselves in situations where they have to protect their

[60] E.g. Khor, M., *Intellectual property, biodiversity and sustainable development: resolving the difficult issues* (London: Zed Books, 2002); Zilberman, D., Ameden, H., Graff, G. & Qaim, M., Agricultural biotechnology: productivity, biodiversity, and intellectual property rights, *Journal of Agricultural & Food Industrial Organisation* 2/3 (2004); Dutfield, G., 'Intellectual property rights, trade and biodiversity: the case of seeds and plant varieties' IUCN background paper to the Intersessional meeting on the operations of the CBD Convention, Montreal, 28-30 June (1999) available at http://www.sristi.org/material/mdpipr2003/MDPIPR2003CD/M5%20Intellectual%20property%20rights.pdf

[61] Shiva (2004) *supra* note 53

[62] Dutfield, G., *Literature survey on intellectual property rights and sustainable human development* (Geneva: UNCTAD, 2002)

research products through IPRs or where they use products protected by third parties. The use of IPRs in public research could potentially compromise the public institutions' mandates resulting in dire consequences for food security.

The *existence* of IPRs however differs from its *exercise*. It is the latter that determines the effect that IPRs have on institutions' mandates. Public research institutions need to exercise IPRs in a manner that does not compromise their public goods mandate. The next chapter looks at some of the ways that public agriculture research institutions can creatively exercise IPRs to ensure that their food security oriented mandates are not compromised.

Chapter Four

Mitigating the tension between IPRs and food security oriented public goods research

4.0 Introduction

The previous chapter looked at the *existence* of IPRs and the *potential* impacts of this on food security and concluded that although an inherent theoretical tension exists between the concept of IPRs and the provision of public goods, a distinction can be made between the existence and the exercise of IPRs. It is the latter rather than the former than determines what effect IPRs have on an institution's or partnership's food security related objectives.

This chapter addresses the *exercise* of IPRs and investigates how the excludability effect inherent in IPRs can be mitigated. It does this within the context of International Agricultural Research Centres (IARCs) and agricultural PPPs. In the first category, the main concern is how IARCs can apply IPRs while maintaining their public good food security oriented mandates and in the second, the concern is how agricultural PPPs can balance the public and private IP related interests.

The way in which IPRs are exercised in IARCs within the CG system is influenced by the IP policies adopted at the system level. This chapter examines the policies to determine whether firstly, they contemplate the use of IPRs and the circumstances in which they do so and secondly, whether they allow for the creative exercise of IPRs thus facilitating the mitigation of the excludability effect of IPRs and ensuring the fulfilment of the Centres' public goods mandate.

The chapter argues that for the creative exercise of IPRs in a manner that balances public and private interests, institutions and partnerships must have IP capacity. This is particularly necessary in PPPs, IARCs and other public research institutions engaging in research with proprietary potential.

The chapter begins by outlining the IP guidelines and policies relating to the Consultative Group on International Agriculture Research (CGIAR or CG). The chapter then looks at examples of how IPRs have been exercised within the CG and elsewhere in a manner that mitigates the excludability effect before outlining IP related challenges in PPPs and ways in which these may be addressed. The final section looks at why IP capacity and IP management are important in PPPs and in public research institutions such as the IARCs.

4.1 The Consultative Group on International Agricultural Research

The Consultative Group on International Agricultural Research (CGIAR or CG), established in 1971, is an alliance of public and private donors made up of countries, international and regional organisations and private foundations that support the network of 15 International Agricultural Research Centres (IARCs). Membership of the CGIAR currently stands at 64 made up of 47 countries, 13 international and regional organisations and four foundations.

The CG's mission is 'to achieve sustainable food security and reduce poverty in developing countries through scientific research and research-related activities in the fields of agriculture, forestry, fisheries, policy, and environment.'[1] The CGIAR expressly states that it 'generates global public goods that are available to all.' The CGIAR was established largely in response to the concerns on famine and genetic erosion that dominated debates in the 1950s, 60s and 70s. The CGIAR is credited with the success of high yielding varieties' that characterised the Green Revolution in Asia and parts of Latin America.

Each of the CG Centres has its own legal identity and mandate usually in terms of commodities. These are represented in the table below. The first four were the original members of the system having been established before the CGIAR; the rest were founded or adopted by the CGIAR to strengthen its mission.

[1] See the CGIAR website www.CGIAR.org

Table 4.1: CG Centres and their mandates

Centre	When founded (when joined CGIAR)	Location	Mandate/crop focus
IRRI-International Rice Research Institute	1960 (1971)	Los Baños, Philippines	Rice
CIMMYT-International Maize & Wheat Improvement Centre	1966 (1971)	Mexico City, Mexico	Maize, wheat
CIAT-Centre for Tropical Agriculture	1967 (1971)	Cali, Colombia	Tropical fruits & forages, common bean, rice & cassava
IITA-International Institute for Tropical Agriculture	1967 (1971)	Ibadan, Nigeria	Cowpea, soybean, bananas, plantain, yams, cassava & maize
ICRISAT-International Centre for Research in Semi-Arid Tropics	1972 (1972)	Hyderabad, India	Chick peas, pigeon peas, groundnuts, pearl millet & sorghum
CIP-International Potato Centre	1970 (1973)	Lima, Peru	Potato, sweet potato, Andean roots & tubers
ILRAD-International Laboratory for Research on Animal Diseases[*]	1973 (1973)	Nairobi, Kenya	-
IFPRI-International Food Policy Research Institute	1974 (1979)	Washington, DC	Food policy
ILCA-International Livestock Centre for Africa[*]	1974 (1974)	Addis Ababa, Ethiopia	-
IPGRI-International Plant Genetic Research Institute[#]	1974 (1974)	Rome, Italy	Agricultural biodiversity
WARDA-Africa Rice Centre	1970 (1975)	Bouake, Cote d'Ivoire	Rice
ICARDA-International Centre for Agricultural Research in Dry Areas	1975 (1975)	Aleppo, Syria	Barley, lentil, faba bean, chickpea, bread wheat, durum wheat, pasture & forage legumes
ISNAR-International Service for National Agricultural Research[+]	1980 (1980)	The Hague, Netherlands	-
ICRAF-World Agroforestry Centre	1977 (1991)	Nairobi, Kenya	Agro forestry
CIFOR-Centre for International Forestry Research	1993 (1993)	Bogor, Indonesia	Forest systems & forestry
IWMI-International Water Management Institute	1991	Colombo, Sri Lanka	Water management
World Fish Centre	1992	Penang, Malaysia	Fish, fisheries & aquaculture

[*]in 1994, ILRAD & ILCA merged to form ILRI – International Livestock Research Institute whose mandate is livestock research; its headquarters are in Nairobi.
[#]in 2006, IPGRI changed its name to Bioversity International
[+]in 2004, ISNAR dissolved and main programs moved to IFPRI
Source: www.cgiar.org

The CGIAR has five focus areas:

(i) sustainable production of crops, livestock, fisheries, forests and natural resources

(ii) enhancing the national agricultural research systems through joint research, policy support, training and sharing knowledge
(iii) germplasm improvement for priority crops, livestock, trees and fish
(iv) germplasm collection including collecting, characterising and conserving genetic resources
(v) fostering research on policies that have a major impact on agriculture, food, health, new technologies and the management and conservation of natural resources

CG Structure and governance

The CGIAR system is a loosely connected network of several components which include the Consultative Group, its Executive Council and partners; the Science Council and the independent IARCs supported by the CGIAR.

The individual CG Centres are the full time research units through which the CGIAR fulfils its mission. Each Centre is legally constituted as an independent self governing institution with its own charter, constitution, research responsibilities and mandates. The Centres function under legal agreements signed between them and the host countries. They function interdependently as members of the CG system.

4.2 International legal environment influencing CG system wide policies

Material held by the CG Centres falls broadly under two categories: the *Ex situ* germplasm collection held in trust and otherwise known as designated germplasm; and breeding material developed by the individual Centres. Virtually all of the *ex situ* germplasm collection is from countries in the South. There has been considerable debate over the status of this genetic material, to whom the CG is accountable and whether or not it is subject to IP protection.

Collectively, the CG Centres hold more than 650,000 accessions of crop, forage and agroforestry species collected from a variety of countries and held in trust for the international community. These accessions include wild species of plants, traditional varieties developed through many generations of selection by farmers, crop breeding

lines and improved varieties. ICRISAT holds about 114,000 accessions of its five mandate crops while ILRI has about 19,000 accessions relating to forages.[2]

The CG accessions are the single largest accumulation of plant genetic resources for food and agriculture (hereinafter PGRFA) in the world and are vital for ensuring global food security. The accessions were collected initially as part of plant breeding programmes for the CG Centres but have since gained great global significance owing to their diversity and richness particularly with regard to traditional farmer-collected varieties, land races and wild relatives of crops.

The Convention on Biological Diversity (CBD) entered into force in 1994; The CBD is an international, legally binding framework for the conservation and sustainable use of biodiversity. The CBD was the first global agreement to cover all aspects of biological diversity: genetic resources, species and ecosystems and also the first to recognise that the conservation of biological diversity is an integral part of sustainable development. It has a direct bearing on all institutions in the field of conservation including the CGIAR. The CBD has three main objectives: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising from such use.[3] It acknowledges the sovereign rights of state parties over their own biological resources[4] and requires access to be on 'mutually agreed terms' and subject to 'prior informed consent'.[5] It provides for the sharing of benefits arising from biotechnologies with developing countries.[6]

Although the CBD covered many outstanding issues relating to PGRs, further clarification on *ex situ* collections held by CG Centres was required. In 1994, the Centres placed their collections under the UN's Food and Agriculture Organisation (FAO) under standard agreements signed between each CG Centre and FAO. This agreements governed the *ex situ* collections.

[2] As at June 2006
[3] Convention on Biological Diversity, (1992), 31 ILM 818, available at http://www.biodiv.org/convention/articles.asp
[4] Article 3
[5] Art 15(4) & (5)
[6] Art 19(2)

The International Treaty succeeded the CG Centre-FAO agreements in 2006 on the signing of agreements between the fifteen accession-holding CG Centres and the International Treaty's Governing Board. The Treaty establishes a Multilateral System for access and benefit sharing into which contracting parties are obliged to place plant genetic resources for food and agriculture (PGRFAs) under its management and control. The PGRFAs to be placed into the Multilateral System are listed in the Treaty's Annex 1.

According to the CG Centre-Governing Board agreement, *ex situ* PGRFA held by the Centres and listed in Annex 1 are to be distributed under the terms of the Treaty's Standard Material Transfer Agreement (SMTA). The Centres began using the SMTA for this purpose in January 2007. At the Treaty's Governing Board's Second Session, it was decided that the Centres should also use the SMTA when transferring non Annex 1 PGRFAs collected before the Treaty entered into force. As from February 2008, CG Centres use the SMTA for transferring all PGRFAs they hold in trust apart from non Annex 1 material collected after the Treaty entered into force. Below is a tabular comparison of the instruments governing various categories of PGRs in the old and new regimes.

One can make a number of observations from these changes: firstly, the Treaty cleared the status of the *ex situ* accessions collected prior to the coming into force of the CBD. Secondly, divisions between categories of materials are maintained in both the old and new regimes although these change. For example, in the old regime, the division was mostly between accessions collected prior to and after the CBD came into force while in the new, the division mostly relates to Annex 1 and non-Annex 1 and pre and post Treaty material.

However in both regimes, the most important distinction is between Centre bred material (and more specifically, PGRFAs 'under development') and other *ex situ* collections. In the new regime, PGRFAs 'under development' are defined by the SMTA as materials derived and distinct from the original material under the Multilateral System that is not yet ready for commercialisation and which the developer intends to further develop or to transfer to another for further development. Breeding lines and improved germplasm would usually constitute this category.

Table 4.2: Governing documents in collections held by the CG Centres

Category	Old regime (before Treaty)	New regime
Ex situ collections	• Pre-CBD collections status unclear • Post-CBD collections →CG Centre-FAO 1994 Agreement (MTA)	• Treaty addresses PGRFAs only • Annex 1 →SMTA from 1 Jan07[7] • Non-Annex 1 (pre-Treaty) →SMTA from 1 Feb08[8] • Non-Annex 1 (post-Treaty) →terms agreed between CG Centre & country of origin/acquiring PGRFAs, CBD or other applicable law[9]
Centre bred material	• Governed by CG Centre specific MTA	• Annex 1,[10] Non-Annex 1 (pre-Treaty), Non-Annex 1 (post-Treaty) →same documents as those in the respective categories in *ex situ* collections above • PGRFAs 'under development' →SMTA, at discretion of developer (Centre) & may be subject to additional conditions[11]
Non PGRFAs	• Pre-CBD collections status unclear • Post-CBD collections →CBD, Agreement between CG Centre & host country; other applicable laws	• Not covered by Treaty; at discretion of Centre but subject to CBD, Agreement between CG Centre & host country; other applicable laws & may be subject to additional conditions

Thirdly, the new regime does not reduce the number of governing documents although it extends to more categories of PGRs not covered under the old regime. Arguably, the old regime provided Centres with more latitude regarding formulating bespoke Centre-specific policies (including on IP) although this was hardly exercised. Under the new regime, Centres are legally bound to follow provisions under the SMTA and can only exercise creativity with regard to PGRFAs under development and PGRs not covered by the SMTA. In practice however, Centres are for the most part involved in developing new and improved lines and therefore flexibility in creating provisions relating to PGRFAs *under development* is more important than in any other category.

A number of facts must be noted: (i) the SMTA covers only PGRFAs; those PGRs that are not for food and agriculture are not covered by the Treaty or indeed the

[7] International Treaty art. 15(1)(a)
[8] International Treaty art. 15(1)(b); IT/GB-2/07/13 and IT/GB-2/07/Report available at ftp://ftp.fao.org/ag/agp/planttreaty/gb2/gb2repe.pdf
[9] International Treaty art 15(3)
[10] The Treaty does not oblige the CG Centres to use the SMTA for this category; the CG alliance adopted the SMTA for this category as part of their policy to ensure consistency and limit the number of documents in use for transfer of PGRFA
[11] The CG's System-wide Genetic Resources Programme has developed a guide for the Centres' use of the SMTA available at http://www.sgrp.cgiar.org/Docs/SMTA/Guide_SMTA.pdf

SMTA; PGRFAs are defined as 'any genetic material of plant origin of actual or potential value for food and agriculture'; genetic material is defined as 'any material of plant origin, including reproductive and vegetative propagating material, containing functional units of heredity'. It is unclear whether this definition includes research tools containing DNA or RNA e.g. DNA markers and primers which do not use material as PGRFA but rather as mapping tools and as marker assisted selection (MAS) tools, *in vivo* RNA which is used mainly as expression tools to confirm phenotype from genotype and genomic DNA which is generally used for DNA fingerprinting and building a DNA library/database. A strict reading of the SMTA would lead to an interpretation that these are not covered by SMTA as the uses are not 'for food and agriculture'.

(ii) Facilitated access under the established Multilateral System is 'solely for the purpose of utilisation and conservation for research, breeding and training for food and agriculture, provided that such purpose does not include chemical, pharmaceutical and/or other non-food/feed industrial uses'.[12] Where Centres are requested to provide materials for purposes other than those covered by the Multilateral System, the SMTA should not be used. No guidance is currently in place as to what Centres should use when faced with such requests e.g. for PGRFAs such as rice with claimed nutritional or medical properties which are processed into a product that is then sold as a nutritional supplement or medicine.

(iii) The SMTA is used to facilitate access under the Multilateral System to other Contracting Parties; the Treaty is silent on how Contracting Parties should deal with non-Contracting Parties as are the agreements between the Centres and the Treaty's Governing Board. A significant number of parties involved in the transfer and acquisition of PGRFAs from and to the CG Centres are non-Contracting Parties e.g. plant breeding companies.

The Centres have attempted to deal with these ambiguities through their system wide policies and through the Statement issued by the Centres on signature of the Agreements between the Centres and the Governing Board. Regarding uses other than

[12] International Treaty art 12(3)(a)

'for food and agriculture', where it is likely that these will be incorporated in downstream improved PGRFA, Centres agree to use SMTA; Centres treat exchanges with non-Contracting Parties in the same way as those with Contracting Parties.

4.3 IP policy in the CGIAR system

Having looked at how the international legal environment influences general policies at the CG system level, and having established what instruments govern different category of materials, this section looks specifically at the IP provisions in the relevant governing instruments. The section pays particular attention to the SMTA and to the CG's Guiding Principles on IP. Attention to the former is obvious; regarding the latter, in most of the incidences where the SMTA is not applicable, Centres use their discretion which is informed by their IP policies which are in turn influenced by the CG's Guiding Principles.

The CG contemplated developing Guiding Principles on IP as early as 1991. At the CGIAR's Mid-Term Meeting in 1992, the CG agreed on a set of working principles on genetic resources and intellectual property. These were largely based on guiding principles adopted by the CG Centres in 1991. The 1992 guiding principles were revised following three international developments. Firstly, the CBD entered into force in 1993; secondly, an agreement signed in 1994 between the FAO and the CG Centres placed the latter's *ex situ* germplasm collections under the auspices of the former. Thirdly, the TRIPs Agreement entered into force in 1995. These developments called for a revision of the 1992 guiding principles on IP.

It was against this background that a panel on IP was convened in September 1994. The panel's report was endorsed in the International Centres Week in 1994. The CGIAR's Guiding Principles on IP and Genetic Resources emanated from the panel's recommendations. The Guiding Principles were revised and endorsed in 1996. They address issues such as national sovereignty, farmers' rights, biosafety and IP protection with respect to designated germplasm and Centre-bred products. [13]

[13] CGIAR., The Guiding Principles on Intellectual Property and Genetic Resources available at www.cgiar.org

Since the 1996 revision, various developments affecting the conservation, exchange and use of genetic resources continued to evolve necessitating further revision of the Guiding Principles. At a meeting in 2000, the Directors General of the CG Centres considered the text of a revised version of the Guiding Principles observing that there had been different and conflicting interpretations concerning IP. In 2005, the Genetic Resources Policy Committee proposed the use of a template for IP policy statements to address the lack of standardisation of IP policies in CG Centres. The template 'is not meant to replace previously approved policy guidelines but to provide a tool that Centres can use to verify that their existing statements address all of the core issues in a consistent and harmonious manner.'[14]

As each Centre has its own mandate and governing body, policy setting in the CGIAR reflects the will of many institutions rather than one. The implementation of the policies is left to the individual Centres. The Guiding Principles on IP and Genetic Resources state that 'the Centres will adopt specific policies for the distribution and use of improved germplasm and biotechnological products following the above Guiding Principles.'

The CG Centres signed agreements with the Governing Board of the International Treaty; system level IP policies are currently under review to reflect these recent developments.

Three questions guide our analysis of the IP related provisions at the CG system level:

(a) whether the CG Centres *can* seek IP protection for research products from both designated germplasm and for Centre bred material;
(b) whether third parties *can* seek protection for research products from both designated germplasm and Centre bred material; and
(c) the terms under which this is allowed

[14] Final minutes of the Genetic Resources Policy Committee, 18th Session, Rome Italy, 29-31 August (2005)

4.3.1 Can CG Centres seek IPRs for research products from designated germplasm and Centre bred material?

The CG Guiding Principles recognise that Centres may need to use IPRs and provide that Centres can only seek IP protection to: (a) support public and private partnerships which pursue mission-based research or which develop and apply research results; (b) assure ready access by others to research products developed or funded by the Centre; (c) ensure the Centre's ability to pursue its research, together with its partners, without undue hindrance; (d) facilitate the transfer of technology, research products and other benefits to the resource poor including, where appropriate, through commercialisation or utilisation or research products; and (e) facilitate the negotiation and conclusion of agreements for access to proprietary technologies of use to the Center's research and in furtherance of its mission. The Principles also contemplate situations where Centres may impose conditions on the supply of their research products and state that these should be in harmony with the CGIAR and Center missions and objectives. A template for IP Policy statements recently approved by the CG Committee on Genetic Resources Policy places emphasis on the Centres' need for full disclosure into the public domain, sharing of materials, data and information generated by Centres. It exhorts that Centres should hold as their basic IP Policy the pursuit of publication and should only seek IPRs when necessary to serve the poor.

The Guiding Principles emphasise that IP protection should not be seen as a means for securing financial returns although in some cases the reality is that IP protection may be a source of operating funds.

4.3.2 Should CG Centres seek IPRs for research products from designated germplasm and Centre bred material?

An instance where protection may be sought is if it helps promote collaborative partnerships which speed up the development of new products and services and facilitates their deployment to the end users – the poor farmers in developing countries. CG Centres may enter into agreement with right holders of protected material but only to facilitate access and availability of the material to developing

nations and only when the benefits of such collaboration outweigh the potential disadvantages. In all cases, the requirements mentioned above must be met.

In deciding whether or not to seek IP protection, CG Centres must consider the transaction cost and the incident management burden.[15] Even though monetary gain by itself should not determine the decision of the CG Centres whether or not to protect a technology, it is nonetheless important and should be considered in the decision making process.

The Centre Directors' Committee Statement to MTM 1998 on Genetic Resources, Biotechnology and Proprietary Science, identified areas that need further clarification. Among these was the issue of benefit sharing for IPRs on Centre bred material and whether and when to allow for IP protection on Centre-bred material where there was no significant input by the recipient or when more than one recipient in a country requests permission to apply for IPRs.[16] This is yet to be addressed.

4.3.3 Can third parties seek IPRs for research products from designated germplasm and Centre bred material?

Under the CG Guiding Principles, designated germplasm is not subject to IP protection or legal claim by Centres or other recipients. This was further reaffirmed by the Centre Directors in the CDC Statement on the Guiding Principles on IPRs relating to Genetic Resources.

Designated germplasm and Centre bred material can be used by recipients for breeding purposes, research and training. The recipients include the private sector. The recipients may seek protection for the *resulting products* of breeding through UPOV or other *sui generis* systems. The recipients cannot preclude others from using the original material. Unlike patenting which requires Centre approval, third parties

[15] See Maredia, K. & Erbisch, F., 'Capacity building in intellectual property management in agricultural biotechnology' in Erbisch, F. & Maredia, K., (eds.) *Intellectual property rights in agricultural biotechnology* (Oxon: CABI Publishing, 1998)

[16] See Bragdon, S., 'Recent intellectual property rights controversies and issues at the CGIAR' in Santaniello, V., Evenson, R., Zilberman, D. & Carlson, G (eds.) *Agriculture and intellectual property rights: economic, institutional and implementation issues in biotechnology* (Oxon: CABI Publishing, 2000) for discussion on the outstanding issues

do not need Centre permission to seek PBRs on research products from designated germplasm or Centre bred material. The Guiding Principles fail to address this.

On collaborative research, the Guiding Principles require the collaborator or grantee to seek permission from the Centre before applying for any IP on the research products. Cells, organelles, genes and molecular constructs can be patented, even those isolated from designated germplasm. Where PVP is sought, it must be through a system that allows for breeders' and researchers' exemptions. With regard to derivatives, the Guiding Principles are mindful of retaining the freedom to operate and avoiding situations where they would have to license back their rights from assignees.

The International Treaty takes CG Centres as both providers and recipients of the material under its ambit. Recipients of the PGRs under the Multilateral System are prohibited from claiming 'any intellectual property or other rights that limit the facilitated access to the plant genetic resources for food and agriculture or their genetic parts or components *in the form received* from the Multilateral System.[17] This qualifier is ambiguous and may be interpreted to allow the patenting of genes isolated and sequenced from the Multilateral System material as they would no longer be 'in the form received'. [18]

The SMTA allows IP protection provided that it does not *limit facilitated access* of the material covered.[19] A recipient who obtains IPRs on any products developed from the SMTA material or its components, is bound by the benefit-sharing obligations of the SMTA as is any assignee. Under article 6.7, a recipient who commercialises a product from SMTA material AND restricts access to the material for research and breeding is required to make payments into the system established by the Treaty. These provisions seem to be contradictory; on one hand, art 6.2 prohibits IP protection where it limits access but on the other, art 6.7 allows such protection (and commercialisation) provided the recipient makes payment. A company that breeds a

[17] International Treaty, art 12(3)(d) (emphasis added)
[18] There have been arguments that even if this is possible, it would not have a negative effect on access as a patent on a gene would most likely cover the isolated and purified gene but would not cover the gene as it occurs in nature; this is however dependent on the breadth of the patent claim.
[19] SMTA, art 6.2

new PGRFA product using SMTA-covered germplasm acquired from a CG Centre, commercialises it and further restricts access is liable to make payment. PVP under UPOV does not restrict further use of protected material for research and breeding although some *sui generis* PVP may not have these exemptions. Other mechanisms for restricting access may be contractual agreements or technological restrictions such as the Genetic Use Restriction Technology (terminator technology).

Patenting a variety derived from SMTA material does not automatically trigger mandatory payments. This has to (i) result in restricting further research and breeding AND (ii) be accompanied by commercialisation. The commercialisation requirement makes it absurd that recipients who restrict access to products derived from SMTA material are not legally bound to make payments unless they also commercialise the product. A recipient can patent cells, organelles, genes and molecular constructs from SMTA material, limit their access through use of broad claims and yet not have to pay the Centre or the Multilateral System.

Under the SMTA, where a CG Centre is the material provider, IP enforcement is the Centre's responsibility; the Centre is required to notify the IP office of the relevant country of the IP violation.[20]

Access to PGRFA under development is at the discretion of the developer during the period of development. Centres are allowed to impose additional conditions relating to further product development; this may include provisions on IP and appropriate monetary payment. On expiry of the protection period of IPR on a product incorporating material accessed from the Multilateral System, the recipient is encouraged but not obliged to place a sample of the product into the Multilateral System.

[20] Statement of CG Centres on signing agreements with the International Treaty's Governing Board

4.3.4 Do CG Centres have the authority to allow third parties to seek IPRs for research products from designated germplasm and Centre bred material?

Before the inception of the International Treaty, there was considerable debate on the question of the Centres' authority to permit third parties to exploit genetic resources held in trust. Under the trustee principle, a trustee's duty is to keep control of and preserve trust property. One of the issues arising from this is whether a CG Centre can permit a third party to secure IP rights over germplasm held in trust.[21] This question does not seem to have been answered directly by the CGIAR at the policy level although it can be argued that if the ultimate end of allowing third parties to seek IP protection for research products from designated germplasm and Centre bred material is to benefit the poor, and facilitate the CG Centre fulfil its mandate, then it would appear that the CG Centre would be acting within its trustee obligations. As the various policy documents currently stand, this issue of trusteeship does not seem to be appreciated thereby allowing for the IP protection of material by third parties for their own commercial interests.

The International Treaty and SMTA are understandably preoccupied with establishing the Multilateral System rather than specifically addressing IPRs. Issues regarding IP protection, commercialisation and restriction of access need clarification and need to be addressed from an IP perspective in addition to the remunerative perspective that they currently take. These however need not be done by the International Treaty; it is clearly upon the CG system to tackle this and offer concise and clear guidelines to the constituent Centres.

Generally, the SMTA and Guiding Principles envisage Centres' engagement with IP. However, each of these read as a whole, reveal stark ideological differences. The SMTA leans to the 'right': it allows providers and recipients to seek IPRs with only a weak rider regarding payments to the Multilateral System. The Guiding Principles on the other hand are firmly planted to the left: they are conservative about aggressively using IPRs, seeking IPRs appears to be the exception to the rule. They are more

[21] See Blakeney, M., 'Agricultural research: intellectual property and the CGIAR system' in Drahos, P. & Mayne, R., (eds.), *Global intellectual property rights: knowledge, access and development* (Hampshire: Pelgrave Macmillan, 2002) for more discussion of the trustee principle

public-good-mandate-friendly and explicitly state that 'to remain true to its mission, the CGIAR has a responsibility to be alert to …[IPR] changes and to be ready to adopt new tools and strategies that enable it to keep faith with its mission.' The public goods mission is central to any revisions of the Guiding Principles. Moreover, as a general philosophy 'The management of intellectual property by Centres will be guided by the CGIAR mission to contribute to food security and poverty eradication in developing countries through research, partnerships, capacity building and policy support.'

Whereas the SMTA is not unsupportive of public goods mandate, it is not explicitly cognisant of this, at least not from an IP perspective. The result of the IP related policies at the CG system level is that a tension though not conflict exists between the two main governing/guiding instruments. This need not be detrimental to the CG Centres; it provides a 'widened space' within which individual Centres can exercise freedom regarding where and how to align their institutional IP policies.

4.4 Reconciling private rights and provision of public goods

Chapter three looked at *potential* reasons why, and circumstances where, public research organisations use intellectual property rights or are exposed to dealing with IPRs. Summarised, these are income generation, facilitating the delivery of research products to the public via the private sector, obtaining leverage with the private sector, avoiding infringing technologies protected by third parties and in order to acquire research products in the public domain. Income generation is not a main factor influencing IARCs' decision on whether or not to seek IP protection of its products. In the other instances above, it is may be more difficult to substitute other practices for the use of IPRs.

This requires the creative *exercise* of IPRs. The excludability effect of IPR encumbered technology can be mitigated by policy and institutional changes. Consider that Microsoft in 2006 released 500 ICT patents before their expiry. CABI (a not-for-profit organisation specialising in scientific research, publishing and communication) agreed to put its books on the internet six months after their publication and on CD free of charge for developing countries. Private biotech firms

have in some cases allowed freedom to operate (FTO) provisions to facilitate the use of IP protected technology in developing countries where it is unlikely that their commercial interests will be affected.[22] In 2000, Harold Vamus, Patrick Brown and Michael Eisen proposed the publication of high quality scientific journals under open access free PLoS journals. This system has proved to be successful; a publication in a PLos journal almost has the same impact factor as that that in *Science* or *Nature*.[23]

These few examples illustrate that the existence of IPRs need not impair the provision of protected technology to the public; the policies underlying these decisions mitigate the excludability effect introduced when IPRs are applied to goods.

The *exercise* of IPRs in a manner ensuring that protected products are maintained in the public domain as much as possible goes beyond the creation of 'public domain friendly' policies. Whilst this is an important first step, implementation of those policies and agreements is crucial in balancing the equation between public goods and private rights. The use of IPRs in the CG Centres is relatively recent; most research projects with potential or actual proprietary technology are ongoing and it could take a while before the effect of using IPRs is seen downstream.

An example of a completed project which illustrates the *exercise* of IPRs in this regard is the Golden Rice project. This was a product development partnership between the International Rice Research Institute (IRRI, one of the CG Centres) and various private partners whose objective was to create rice fortified with beta-carotene in order to address the pervasive vitamin A deficiency in rice growing regions. The freedom to operate review showed that about 70 patents (including applications) were applicable to the improved rice. This potential constraint was resolved by 'a straightforward IP management strategy'. Krattiger and Potrykus report that 'contrary

[22] Ryan, J., 'International public goods and the CGIAR niche in the R for D continuum: operationalising concepts' in CGIAR Science Council *Positioning the CGIAR in the research for development continuum* (Rome: Science Council Secretariat, 2006)
[23] Heselmans, M., Jonge, B., Vroom, W., Louwaars, N., 'Sharing biotechnology with developing countries' start document for the symposium 'Reconsidering intellectual property policies in public research' Wageningen University, 11 April (2008)

to what many commentators state, the licensing process was relatively uncomplicated, with the involvement of commercially experienced people.'[24]

Judging from the number of patents involved and the number of licenses issued, the process could only have been uncomplicated *because* of the involvement of commercially and IP savvy people (public relations and other factors aside). Moreover, a lot of the IP capacity particularly regarding negotiation must have been from the private sector: 'These core patents were licensed to Zeneca… [which] then negotiated access to *all* possible necessary patents, including intellectual property from [other companies].'[25]

The Zeneca-led negotiations resulted in all the companies providing access to their technologies 'free of charge for defined humanitarian research and use of Golden Rice in developing countries.'[26] Golden Rice is available under humanitarian use which is defined as use in developing countries by resource-poor farmers (earning less than US$10,000 per year from farming). This provision is an example of how the excludability effect of IPRs can be reversed to ensure the public's access to protected technology.

Another example of creative exercise of IPRs is a partnership between Donald Danforth Plant Science Centre (a US not-for-profit plant sciences research institute), Sathguru Management Consultants and the International Crops Research Institute for Semi Arid Tropics (ICRISAT, a CG Centre) for the development of groundnuts resistant to tobacco streak virus, a disease that decimated groundnut production in India with losses of more than US$65million in 2000. The partnership acquired coat protein (CP) technology (vital for conferring resistance to the viral infection) from Monsanto through a non-assert agreement. This allowed the CP technology to be used for non profit public good. The CP technology is available free of royalties and

[24] Krattiger, A. & Potrykus, I. 'Golden Rice: A Product-Development Partnership in agricultural biotechnology and humanitarian licensing' in Krattiger, A. *et al*. (eds.) *Intellectual property management in health and agricultural innovation: a handbook of best practices* (Oxford: MIHR & Davis: PIPRA, 2007) at p CS12
[25] Id.
[26] Id.

upfront payments to public institutions planning to develop the varietal groundnut.[27] The partnership was able to negotiate for the CP technology from Monsanto through a non-assert agreement demonstrating the need for IP capacity. The non-assert agreement itself is an example of how protected technology can be made available to the public while mitigating the excludability effect of IPRs.

Open source biotechnology is another option increasingly cited as having the potential to mitigate the excludability effect in IPRs thereby balancing private rights with the provision of public goods.[28] Similar to the open source software model, this entails pooling together technologies which are then made freely available under specified terms. The practical workings of open source biotechnology are however yet to be put to test. An often cited example of open source biotechnology is CAMBIA's open technology bank called BIOS. CAMBIA is an Australian non profit organisation that engages in life sciences based research. BIOS is a technology development and sharing initiative where protected technology is freely available for users who have to contribute the improvements they make to the core toolkit under the terms of the Biological Open Source Licence.[29]

The use of non-assert agreements, humanitarian licenses and other contracts that ensure the public goods mandate of public research organisations is not compromised requires IP capacity including that in drafting appropriate clauses and contracts, IP negotiation with third parties and research partners and overall IP management. The same goes without saying in establishing or being involved in any open source arrangement.

4.5 Challenges in balancing IPRs and the provision of public goods

PPPs must pursue IP strategies that will maximise the social value of their proprietary products. However, PPPs encounter various IP challenges; these may be due to the differences in IP ideology and practice as is discussed in chapter five or may generally

[27] Medakker, A. & Vijayaraghavan, V., 'Successful commercialisation of insect-resistant eggplant by a Public-private partnership: Reaching and benefiting resource-poor farmers' in Krattiger *et al.* (2007) *supra* note 24
[28] Heselmans *et al.* (2008) *supra* note 23
[29] Hope, J. Biobazaar: The open source revolution and biotechnology (Cambridge: Harvard University Press, 2008)

be influenced by the partnership's structure, the nature of research and the technology involved. In product development PPPs, most of these tend to be of a highly practical nature. The central challenges are ensuring high quality and low cost production, sustained supply, affordable pricing and effective delivery of products while meeting the partnership's social goals. Agricultural PPPs are breaking into completely new territory with their IP negotiations. Some lessons can be learnt from the health sector which has had relatively more experience with product development partnerships; some of the examples below are drawn from the health sector and are useful in providing insights into the workings of PPPs in an IP context.

A basic IP issue relates to the negotiation on the ownership of both background IP and IP created with PPP resources. This is particularly challenging where a partnership's membership is staggered or where there are various background IPs owned by individual partners in the PPP. The partnership has to make decisions regarding the terms under which to own or to share the IP created through the research it has funded. Generally, pre-existing knowledge is licensed or donated to the partnership by the right holding partner. The partnership must agree on the terms under which this occurs. As a general rule of thumb, partnerships own the IP for the products they create. The Medicines for Malaria Venture (a health PPP) employs a 'keep what you fund' IP strategy in this regard: it owns any of the IP created through the research it has funded. The ownership of IP created by the partnership may be joint or single or held by a combination of some partners and not others; this has to be agreed to by all the parties.

Partners must agree on the logistics (such as which partner files, who bears the costs and in what proportion) of filing and payment of costs for joint patent applications. In a partnership between UC Berkeley, One World Health and Amyris for improved production of a natural product treatment for malaria, patent costs for UC Berkeley's pre-existing patents are shared between the other two partners while UC Berkeley's patents on IP arising from collaborative research may be filed by UC Berkeley and licensed to either of the other two partners or both; the costs for these are shared by

the licensee on a pro rata basis. In other words, UC Berkeley does not pay for the costs of its patents.[30]

PPPs also have to determine the terms on which their commercial partners can retain control of the IP. This is usually through licensing. Strategies ensuring that PPP activity is not held up are vital to the accomplishment of the partnership's objectives. Partners need to reserve the right to retain control of the IP especially in late stage product development to ensure production of the relevant technology. When in-licensing products or technologies, PPPs may seek to control rights to out source the project to third parties. It is important for the PPP to hold on to IP rights in the early stages so as to have more to bargain with in the later stages. The International Aids Vaccine Initiative (IAVI) arranges contracts with commercial partners so that if the latter choose not to continue development, IAVI gains access to any background patents it needs to be able to produce the product and continue development through a new partner. Kettler and Towse propose establishing explicit volume deals with the private sector partner; should the partner fail to manufacture the product at the volumes needed to meet the developing country need, the PPP can acquire the rights to the process and use contract manufacturers to meet the supply needs.[31] Oehler advocates for the use of milestones in initial licensing agreements to ensure that key goals are met along the product development pathway.[32]

For a PPP with primarily social objectives, nonexclusive licenses of the partnership's final product to other parties are preferred as opposed to exclusive licenses. Licenses can also be royalty free. This is mainly to ensure the timely delivery of the product through a variety of licensees. In the partnership between IAVI and the Indian Council of Medical Research (ICMR, an Indian government agency), both parties jointly own all new IP generated by the partnership. ICMR has the exclusive right to use all IP to benefit India and other named countries. ICMR grants nonexclusive royalty free and sub-licensable licenses to all new IP arising out of the project to selected third parties in order to make, use, sell and import HIV/AIDS vaccine in

[30] MIHR/PIPRA., 'Improved production of a natural product treatment for malaria: OneWorld Health, Amyris, and the University of California at Berkeley' in Krattiger *et al.* (2007) *supra* note 24
[31] Kettler, H. & Towse, A., *Public-Private Partnerships for Research and Development: Medicines and Vaccines for Diseases of Poverty* (London: Office of Health Economics, 2002)
[32] Oehler, J., 'Using milestones in healthcare product licensing deals to ensure access in developing countries' in Krattiger *et al.* (2007) *supra* note 24

countries other than those covered by the agreement.[33] Sometimes non exclusive licenses are used to ensure competition thereby lowering the price of the final product.

Besides the usual IP challenges encountered in product development, PPPs have to contend with issues around balancing individual partners' objectives and the partnership's mutual objectives. It is presumed that the public sector partner's objectives are met by the PPP's public goods goal; how can private sector partners benefit from the partnership? One way that IP strategy can help achieve this is through technology and market segmentation. Where a technology has many potential uses e.g. across certain diseases, the IP may be shared according to disease use especially if the partnership is addressing a particular neglected disease affecting the poor. The private sector partner may acquire the IP rights to use the technology for diseases other than the neglected disease. In the UC Berkeley-One World Health-Amyris partnership, Amyris has licenses for non-malaria indications of the protected technology.[34]

Partnerships may also share IP on the basis of current and future improvements of the technology. The private sector partner can acquire rights to the improvements made to the technology. For example, where a transgenic plant is protected, IP rights to make use and sell the technology might include the rights to the crosses made with that plant, or may include the right to use individual components of the genetic construct in other constructs and other transgenic plant events.

A more common IP strategy used to satisfy both public and private sector partners is that of segmenting the market through tiered pricing; private sector partners retain control of the IP to use in the 'paying world' while the public sector partners control the use of the technology for the developing country markets. The rationale is to reduce the financial barriers to technology access for low income markets while providing commercial parties with a profitable market in richer countries. This is common in global health partnerships particularly those dealing with vaccine development such as IAVI mentioned above: ICMR has the exclusive rights to use IP

[33] Satyanarayana, K. 'HIV/AIDS vaccine: Indian Council of Medical Research' in Krattiger *et al.* (2007) *supra* note 24
[34] MIHR/PIPRA (2007) *supra* note 30

developed in the partnership for use in India and other named countries while IAVI retains the rights to use the IP rights with respect to the rest of the world.

In sharing royalties from final products, especially where background IP from some parties is involved, PPPs have to work out, preferably at the onset, the proportions for royalty payments. Parties should negotiate to avoid unrealistic expectations brought about by royalty stacking. This is when several different owners of IP expect a royalty the sum of which may make commercialisation economically unfeasible. Pro rata sharing or fixed fee payments may be used to address royalty stacking related problems.

Other mechanisms of assembling IP to ensure easier access to inventions from third parties includes the use of patent pools; these allow for cross licensing of rights, and provide a framework for out-licensing the pooled IP to third parties. There is however virtually no experience in patent pools in both health and agriculture PPPs and their application and success is yet to be seen.[35]

4.6 Intellectual property management

There are many reasons why IARCs and PPPs with social welfare objectives such as the achievement of food security should invest in IP management and building IP capacity. Firstly, as discussed above and in the previous chapter, the way in which IPRs are exercised is more important than their mere existence. For IARCs and food security oriented PPPs, the provision of public goods is central to their respective missions and objectives. This means that appropriate IP strategies must be adopted that will allow for the creative exercise of IPRs in a manner that achieves the food security related objectives in the context of private rights. IP management is a fundamental element in the public sector's strategy of putting IP to work for the public good. This requires an appreciation of the competing interests in the provision of public goods through use of private rights and is particularly important in PPPs which in addition, have to maintain the interest of the private sector. Kettler and

[35] Krattiger, A. & Kowalski, S., 'Facilitating assembly of and access to intellectual property: focus on patent pools and a review of other mechanisms' in Krattiger *et al.* (2007) *supra* note 24

Towse argue that the most important strategic tool in a PPP is the partnership research contract, particularly the conditions on IP:

> "PPPs must be as aggressive in the way they use IP as any commercial unit but for a different purpose – namely to pursue their social objective…This involves the negotiation of creative IP arrangements that do not scare off companies but also allow the PPP enough control to ensure their ultimate objective, a difficult challenge."[36]

Balancing the competing interests can only be achieved by the engagement of personnel with appropriate IP skills and knowledge. Failure to invest in IP capacity may result in skewing the power relations between the public and private sector partners in the case of PPPs. For IARCs and other public research organisations, lack of IP capacity may result in misuse of the institutions' intellectual assets by third parties, infringement of third party IP by the institutions and loss of opportunities to partner with others who may help the institutions achieve their respective missions.

In PPPs, the public and private sector perspectives on IPRs as a concept differ. The IP management practices and strategies also differ across the two sectors as is discussed in chapter five. The rationales for food security PPPs are discussed in greater detail in chapter six. The main rationale is found to be the complementarity of synergies between the two sectors. The concept of synergy has its basis the assumption that partnership arrangements can achieve more than the individual agents involved could independently. Ideally, parties in a PPP have to find the middle ground in order to achieve their mutual objectives. PPPs have the potential to amplify or ease the tension between the use of IPRs and the provision of public goods. Successful PPPs are those that manage to mitigate the excludability effect of IPRs to ensure the achievement of the partnership's social welfare goals while at the same time ensuring that the respective partners' goals and expectations are met. This involves continual negotiation to balance the IP interests of the partners involved. This can only happen if there is IP capacity.

[36] Kettler & Towse (2002) *supra* note 31 at p67

Every research institution has some form of intellectual assets which it may decide to convert to intellectual property. "IP" therefore contains both the concept of private creativity and the concept of public protection for the results of that creativity.[37] Intellectual assets in themselves are important not in the least because of their potential to be converted to IP. Management must be seen in the light of both intellectual assets and intellectual property.

Management of intellectual assets involves more than the protection and exploitation of IP. Given the growing importance of IP in the knowledge economy, failing to manage it may expose an institution to serious risk: firstly, there is the danger that the institution's IP might be unlawfully appropriated by third parties and equally important is ensuring that the institution does not infringe IP belonging to others. An institution's IP management functions must be integrated into its wider institutional management functions.[38]

IP management increases the effectiveness of partnerships. It allows technologies to be transferred not only in one direction but in more complex ways and thus increasing the partnership's potential to benefit more people. This is particularly important in product development partnerships involving multiple partners. IP management and IP capacity facilitates the adoption of creative licensing practices such as those discussed in the section above. These have the potential to maximise the social benefits arising from PPPs.

For IARCs and other public research organisations, building and increasing IP capacity and management may allow the institution to seize new opportunities and take advantage of previously unavailable options:

[37] As aptly argued by Sherwood, R., *Intellectual property and economic development* (Oxford: Westview Press, 1990), IPRs is a redundant expression as the concept of rights is implicit in any understanding of property.

[38] Wolson, R., Intellectual property tools, innovation and commercialisation of R&D: Options to assist developing countries in positioning themselves to reap the benefits of a stronger intellectual property regime, with special reference to the role of intellectual property management in research organisations, paper presented at 'The ICTSD/UNCTAD/TIPS Regional Dialogue on Intellectual Property Rights, Innovation and Sustainable Development in Eastern and Southern Africa' South Africa, 29 June - 1July (2004)

> "Without effective IP management, the public sector risks squandering the … powers that the … IP system provides. Intellectual property is a tool, and the impact of a tool depends on *who* uses it, *how* it is used, and for *what* purpose."[39]

IP management includes building IP capacity, clarifying the role of institutions, developing an inventory of intellectual assets, developing ownership of IP where appropriate, undertaking technology transfer and marketing the IP.[40]

Various options regarding IP capacity are available to IARCs in the CG. These may engage the services of the Central Advisory Services on IP (CAS-IP), a CG agency offering IP advisory services to the CG Centres. These are usually given on a request basis. CG Centres also have the option of hiring or outsourcing IP counsel. These options should however be in addition to having in house IP management and capacity.

In house IP capacity would address other intellectual asset management aspects that are vital to an institution. These include developing and implementing an institution's IP policy and guidelines, educating scientific and other research staff in IP and its implications on their work, identifying intellectual assets and carrying out IP audits and providing continued hands-on IP staff training. Some of these functions may require collaboration with external IP counsel.

Increasing IP capacity in public research institutions is important in building networks in technology transfer and licensing. This is particularly important for institutions such as the CG Centres which have a shared food security oriented mission. In house IP practitioners could exchange ideas and experiences, work towards establishing best practices and identifying performance standards for the CG system, their respective institutions and even specific projects. Increasing IP capacity in such institutions can raise the quality of debate from the existence of IPRs to the exercise of IPRs. It can help achieve a common perspective on IPRs across the system and assist CG Centres

[39] Mahoney, R. & Krattiger, A., 'The role of IP management in health and agricultural innovation' in Krattiger *et al.* (2007) *supra* note 24

[40] Persley, G., (1999) Agricultural biotechnology and the poor: Promethean science available at http://www.cgiar.org/biotech/rep0100/persley.pdf

in refining and streamlining their IP policies and practices in a manner that outsourced IP counsel cannot. CAS-IP attempts to bring IP personnel from the CG Centres together to facilitate exchange of experiences and ideas. It is however unclear whether these IP personnel have enough capacity to influence the IP policies at a system and institutional level. The risk of this is lack of ownership of the 'top-down' policies and a break in the implementation chain as IP personnel struggle to put into effect policies into which they had no input.

One of the decisions that IARCs, other public research institutions and PPPs have to make in the context of management of intellectual assets is whether or not to convert the intellectual assets to IPRs. This is usually on a case by case basis although underlying IP policies (and research agreements in the case of PPPs) have a direct influence on the institution's or partnership's IP management strategy. For PPPs, it is vital that parties are involved in negotiating a balanced research agreement. This can only be possible if there is requisite IP capacity in all the partners involved. Failure to have the prefatory IP capacity risks having an uneven IP platform from which a project is launched. This could have grave implications including compromising the social welfare goals of a PPP.

In deciding whether or not to seek IP protection, IARCs and public research organisations have to consider certain factors. Maredia and Erbisch[41] summarise these as: what type of IP should be sought? How should the institute use its protected technology – should it license it to others to generate income, license it to others royalty free, or use it as a bargaining chip in negotiations with the private sector? Where technology is protected by third parties, a public research institute has to decide whether it should license the technology or invent around it; where the institution negotiates a license with a third party right holder, it has to decide what terms and conditions to include in order to allow for its freedom to operate. Decisions such as these can only be made where there is sufficient IP capacity.

Establishing a technology transfer office (TTO) is often suggested to facilitate commercialisation of research. Agriculture research institutions must be aware of the

[41] Maredia & Erbisch (1998) *supra* note 15

costs of establishing and running a TTO. Technology transfer will not make any institution rich because building a robust programme requires sustained financial investment; strategies to set up and operate a TTO must be firmly grounded in realistic economic expectations. A TTO requires carefully planned and consistent long-term financial and administrative support. A critical mass of R&D activity is necessary to justify the costs of a fully functioning TTO. Public research institutions particularly those in developing countries may decide to share costs among a consortium of research institutions. This however presents many challenges but can be managed by clearly articulating policies on ownership, the distribution of income from commercialised technology and the mechanisms for the prevention and resolution of conflicts of interest.

Where the costs of running a TTO do not justify the benefits, a research institution should not establish one. Decisions on whether to seek IP protection should be taken on a case by case basis. Research institutions must be aware of the financial and human resource costs associated with IP protection. These include administrative costs related to filing a PVP or patent application, the application fees, the costs for testing, conducting searches and other attendant costs, and renewal fees.

Although CG Centres and most NARIs (national agriculture research institutes) in developing countries have a variety of options for protection of agriculture related proprietary technology, most of the institutions have preferred to follow a defensive publishing and other non-IPR strategies in order to keep inventions in the public domain.[42] It appears that this is adopted as the default in many NARIs and in some CG Centres as discussed in chapter six. Two presumptions can be made from this observation. Firstly, it is possible that defensive publishing as a default IP strategy is done out of a lack of understanding and appreciation of the difference between the existence and exercise of IPRs. Secondly, it is possible that defensive publishing and other related strategies are adopted as informed decisions and in full appreciation of

[42] Non-IPR protection strategies include biological protection through hybridisation, conventional seed law through certification and use of contracts such as Material Transfer Agreements. Of course the drafting and implementation and execution of MTAs require IP capacity. See Louwaars, N., Tripp, R., Eaton, D., Henson-Apollonio, V., Hu, R., Mendoza, M., Muhhuku, F., Pal, S. & Wekundah, J., *Impacts of strengthened intellectual property rights regimes on the plant breeding industry in developing countries: a synthesis of five case studies* (Wageningen: Centre for Genetic Resources, 2005) for further discussion

the financial and human costs required in seeking IP protection. In the first instance, the inference is that these institutions do not have adequate IP capacity that would allow them to formulate and execute policies which facilitate the creative exercise of IPRs without compromising the institutions' public goods mandate. In the second case, the inference is that the institutions have sufficient IP capacity not only to appreciate the difference between the existence and exercise of IPRs but also to conduct cost-benefit analyses regarding IP protection.

Although focussed and conclusive studies are yet to be conducted on IP capacity and management strategies in agricultural public research institutions in developing countries, anecdotal evidence, including that garnered by the author, suggests that the first presumption is more likely: some IARCs and agricultural public research institutions in developing countries pursue defensive publishing and other such strategies as the default due to lack of IP capacity in using alternative creative strategies that would still ensure the achievement of their food security oriented mandates. Of course this is not to say that increasing IP capacity would change the institutions' IP strategies and practices; it may well be the case that even where IP capacity is sufficient, the institutions would not abandon defensive publishing and other related IP strategies entirely. This is due to the influence of cost and related factors.

4.7 Conclusion

As we have seen, CG IP policies are in part influenced by the International Treaty, general principles underlying conventions such as the CBD and the CG's public goods mandate. Although the tone underlying the IT's SMTA (through which most of the CG held material is transferred) and the CG's Guiding Principles is different, both allow for the mitigation of the excludability effect of IPRs and acknowledge the use of IPRs in the CG Centres. Moreover, as the discussion above clearly illustrates, the Guiding Principles are broad enough to allow individual Centres to creatively exercise IPRs in a manner that balances their public goods mandate against that of potential private partners.

Using IPRs in food security research need not exclude the poor from accessing the benefits from research. This chapter has illustrated that there are examples of creative exercise of IPRs by public agricultural research institutions and in PPPs particularly product development partnerships. These include the use of non-assert agreements and licensing provisions that guarantee end products are accessible to the poor while meeting the needs of the commercial partners.

Indeed, as the chapter shows, IP capacity is vital and central to all agricultural public research institutions, such as those discussed above, which have food security oriented mandates. Such institutions must invest in IP capacity to ensure the formulation and execution of creative IP policies and agreements, which in turn, will guarantee the fulfilment of the institutions' public goods mandate. Moreover, where PPPs are concerned, IP capacity is vital in negotiating research and partnership agreements, in executing them and in dealing with other downstream commercial partners.

Chapter Five

The role of IP law in food security oriented PPPs

5.0 Introduction

The preceding two chapters have argued that it is not the existence of IPRs but their exercise which influences the delivery of public goods and in the context of food security oriented PPPs, the achievement of their social welfare related goals. Progressing with this theme, this chapter distinguishes between IP on two levels: one, the (vertical) influence of the international IP regime on national legislation and two, the (horizontal) application or expression of IP between collaborating parties in the case of PPPs.

Undoubtedly, the international IP regime has influenced national law; the TRIPs Agreement single-handedly imposed minimum standards that all WTO members must provide for the protection of intellectual property. This chapter examines how the international IP regime is implemented in Kenya and India and how this affects the conduct of research in food security oriented PPPs in their jurisdictions.

Some scholars have suggested that pro-poor agricultural PPPs are constrained by different and sometimes conflicting incentive structures.[1] As a subset of 'incentive structures', IP could potentially constrain the success of food security partnerships. In PPPs generally, the public sector's understanding and interpretation of IP—firstly, as a concept, secondly, as expressed in international and national instruments and thirdly, as it related to the sector's mandate—substantially differs from that of the private sector's. These differing perspectives may influence the conduct of research in a PPP.

This chapter presents a typology of IP users and their perceptions on IP. This typology is used in the succeeding chapter to map the variations in IP related perceptions in the respective case studies.

[1] Spielman, D. & Grebmer, K., Public-private partnerships in international agricultural research: an analysis of constraints, *Journal of Technology Transfer* 31/2 (2006) 291

The ultimate objective of this chapter is to determine the impact of IP legislation on the case studies. Combining the findings from the preceding two chapters and the vertical-horizontal distinction, this chapter argues that the existence of international and national IP regimes are not nearly as important in the conduct of research in food security PPPs as institutional policies and the partnership agreements adopted by institutions operating within these regimes. What matters are not the international or national IP regimes but the actors' different IP perceptions and how these are expressed in the partnerships. Capacity is especially vital at this level.

5.1 International IP regime relevant to agricultural R&D

IPRs are an economic creation granted to inventors of intangible property to protect their innovations and creations and to reward innovative and creative activity. As a concept, IPRs have not been problematic; what has been contentious is the nature of their meaning and the various interpretations with varying results and implications for different groups and jurisdictions. This chapter deliberately omits the background and history to the various international instruments establishing the IP regime; it adopts a legal and technical approach in examining the relevant international legal instruments.

5.1.1 The TRIPs Agreement

A lot has been said about patentable subject matter under TRIPs article 27 and particularly the exceptions under article 27(3)(b). In the interest of clarity and brevity, this part restricts itself to three issues: (i) whether agriculture biotechnology inventions fall under patentable subject matter as prescribed by article 27; (ii) the scope of, limits to and exclusions from patentability; and (iii) what plant varieties are for the purpose of article 27(3)(b) and how this has been implemented in the host countries of the case studies.

5.1.1.1 TRIPs Article 27

Article 27(1) obliges WTO members to provide for the protection of inventions, whether products or processes, in all fields of technology by way of patents. To be patentable, the inventions must be new, involve an inventive step and be capable of industrial application.

This requirement is however subject to exemptions provided under article 27(2) and 27(3). The former allows for exemption in order 'to protect *order public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment.' What constitutes '*order public* or morality' and 'serious prejudice to the environment' is not prescribed and is at the discretion of the member state concerned.

Under article 27(3)(a), members states may exclude from patentability 'diagnostic, therapeutic and surgical methods of treatment of humans or animals'. Article 27(3)(b) has been the subject of many a debate particularly in the context of flexibilities available to developing countries. The use of the terms *shall* to refer to inventions and *may* to refer to the exemptions means that protection of inventions is mandatory (provided they meet the prescribed criteria) while exemptions are discretionary.

At the risk of being repetitive, article 27(3)(b) is briefly analysed below. It states that members may exclude from patentability:

> "plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and microbiological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by any combination thereof…"

Applying a strict interpretation under the legal literal rule, a deconstruction of article 27(3)(b) can be represented below.

Table 5.1: Protection under TRIPs article 27(3)(b)

Must be protected	**May** be protected
• Micro-organisms & macro-organisms other than plants & animals • Non-biological processes for the production of plants or animals • Microbiological processes for the production of plants or animals • Non-essential biological processes for the production of plants and animals • Non-essential biological processes for the production of micro-organisms and macro-organisms • Plant varieties	• Plants • Animals • Essentially biological processes for the production of plants or animals • Essentially biological processes for the production of micro-organisms and macro-organisms

Some terms under article 27(3)(b) are ambiguous inviting a wide range of interpretations. It is often argued that developing countries should take advantage of this ambiguity and flexibility and apply an interpretation consonant with their national priorities and level of development.

Micro-organisms

To begin with, there is no definition of what a micro-organism is or what constitutes 'essentially biological processes'. Recommending that developing countries use a higher threshold for patent protection in respect of living matter, Blakeney writes that there is no commonly accepted definition of 'micro-organism' either in science or in patent office practice; the key issue for protection being not the subject matter, but rather whether or not the invention meets the patent granting criteria.[2]

Essentially biological processes, non-biological processes

On 'essentially biological processes' the inference is that biological processes that are not essential must be protected. There is no evidence of a scientific meaning of 'essential'; the presumption in this context is that it is a term addressing the extent of excludable subject matter and therefore open to different interpretation. If it is possible to attribute a percentage of a final plant, animal, macro or micro-organism to a specific biological process or step of processes, what share would be considered 'essential'? Although this oversimplifies the reality of scientific research, it demonstrates the possibility, at least in theory, of varying interpretation of the significance of specific biological processes.

Modern biological processes may be classed as being 'non-biological'.[3] Non-biological processes for the production of plants and animals **must** be protected.

Effective sui generis system

Plant varieties **must** be protected; TRIPs offers no definition for plant varieties. There are three options available for the protection of these: (i) protect plant varieties by patents; (ii) protect plant varieties by an *effective sui generis* system; or (iii) protect plant varieties by a combination of both (i) and (ii). TRIPs offers no guidance as to what is meant by 'effective'. Blakeney offers four suggestions: effective through enforcement; effective to protect both

[2] Blakeney, M., Access to genetic resources, gene-based inventions and agriculture, background paper to the 'How intellectual property rights could work better for developing countries and poor people conference' London, 21-22 February (2002)

[3] Correa, C., The GATT Agreement on trade related aspects of intellectual property rights, *E.I.P.R* 16/8 (1994) 327-335 however questions if a plant or animal can be produced by a non-biological process

modern and farmers' varieties; the rights should be protected in accordance with national objectives referred to in the TRIPs Agreement; the protection should be consistent with international obligations agreed to and assumed by members such as those under the CBD.[4]

Some scholars have argued that a *sui generis* system has generally been understood to mean a system modelled on the UPOV Conventions[5] not in the least because, to date, UPOV represents the only internationally recognised system of plant variety protection. Matthews argues that even when *sui generis* is not read as UPOV-like system, an 'effective' *sui generis* system would most likely be one that is determined and approved by industrialised countries.[6]

With regard to plants, Member States have four rather than three options: they may choose *not* to protect plants at all; protect by use of patents; protect by using a *sui generis* system; or protect using a combination of patents and a *sui generis* system.

TRIPs makes no reference to UPOV and, consequently, Member States are not obliged to join UPOV or model their *sui generis* legislation on the UPOV Conventions. Watal suggests that the TRIPs agreement's failure to mention the UPOV Conventions may have been because the 1991 Convention was not yet in force at the time of the TRIPs negotiations while the 1978 Act was considered inadequate.[7]

Although countries are free to legislate on any form of 'effective' *sui generis* system, most developing countries—especially those that did not provide for PVP protection prior to their accession to the WTO—have tended to use UPOV as a template. This may be attributed to three of many factors: the fact that there are no readily available alternative *sui generis* systems for developing countries to model their laws on; possibly because the UPOV model is often promoted though bilateral trade agreements; and the unwelcome reception of creative models of *sui generis* systems may make countries resigned to accepting UPOV-like national legislation. Brave attempts by India and by the African Union to produce a *sui generis* system

[4] Blakeney (2002) *supra* note 2
[5] Mugabe, J., Barber, C. Henne, G., Glowka, L. & La Vina, A., 'Managing access to genetic resources: National policy and legislative framework' in Mugabe, J., Barber, C. Henne, G., Glowka, L. & La Vina, A., (eds.) *Access to genetic resources: strategies for sharing benefits* (Nairobi: ACTS Press, 1997)
[6] Matthews, D., *Globalising intellectual property rights: the TRIPs Agreement* (New York: Routledge, 2002)
[7] Watal, J., *Intellectual property rights in the WTO and developing countries* (London: Kluwer Law International, 2001)

resulted in the former's application to join UPOV being suspended[8] and severe criticism of the latter's Model Law by UPOV officials.

It is reported that UPOV officials amended 30 articles of the OAU Model Legislation on the Protection of Rights of Local Communities, Farmers and Breeders and for the Regulation of Access to Biological Resources to align them with the UPOV Conventions.[9] This, and UPOV's reaction to India's attempt at producing a UPOV-alternative *sui generis* legislation, suggests that the 'flexibility' under TRIPs article 27(3)(b) regarding the *sui generis* option is little more than lip service. UPOV-like PVP is the reality in most developing countries.

Regional and bilateral trade and investment treaties are in part responsible for the promotion of the adoption of UPOV based PVP legislation in developing countries.

5.1.1.2 Agricultural biotechnology

With regard to modern agricultural biotechnology, scrutiny of article 27 yields three possible interpretations: (i) no exceptions option; (ii) all exceptions option; and (iii) some exceptions option.[10]

Under the 'no exceptions option', animals, plants, micro-organisms, essential and non essential micro-biological and macro-biological processes, non biological processes and plant varieties are patented. The 'all exceptions option' construes the terminology broadly or narrowly to ensure the absolute minimal protection that is legally permissible while keeping as much subject matter outside of patent protection. The third option consists of a combination of the first two options and results in a wide range of permutations between the two extremes. The third column in the table below merely presents one of the many possibilities.

[8] UPOV has made it clear that if India is to join UPOV, it has to change its provisions on farmers' rights

[9] Singh, H., Emerging plant variety legislations and their implications for developing countries: Experiences from India and Africa, paper presented at the 'National Conference on TRIPS: Next Agenda for Developing Countries' Hyderabad, 11-12 October (2002)

[10] Dutfield, G., Muraguri, L. & Leverve, F., 'Exploring the flexibilities of TRIPs to promote biotechnology capacity building and appropriate technology transfer' a report prepared under the European Commission's 6th Framework Programme for Research as part of the project 'Impacts of the IPR Rules on Sustainable Development' (London:Queen Mary, University of London, 2006)

Table 5.2: Agricultural biotechnology options under TRIPs article 27

'**No exceptions'** option	'**All exceptions**' option		'**Some exceptions**' option*	
Provide	Provide	Exclude	Provide	Exclude
• Micro-organisms (broadly defined) • Animals and plants (including plant varieties by patents and an effective *sui generis* system) and their parts including seeds, somatic cells, gametes, cells, genes • Non-biological processes • Essentially micro and macro biological processes • Plant varieties also (either by patents or by *sui generis* system or by any combination thereof)	• Micro-organisms (narrowly defined e.g. unicellular organisms in the range of 10^{-5}m maximum size) • Microbiological processes that are specific to microorganisms • Non-biological processes • Plant varieties (only by an effective sui generis system e.g. modelled on UPOV 1978)	• Whole animals and plants (including plant varieties) and their parts including seeds, somatic cells, gametes, genes and gene products • Essentially biological processes for the production of plants or animals (even with substantial human intervention)	• Micro-organisms (narrowly defined) • Microbiological processes found in micro-organisms that are found in larger organisms too • Non-biological processes • Plant varieties (only by an effective sui generis system e.g. modelled on UPOV 1978 or 1991) • Genes (as chemicals with specified function)	• Whole animals and plants • Essentially biological processes for the production of plants or animals

Source: Dutfield et al (2006) with modification

* other permutations and combinations are possible

5.1.2 The UPOV Conventions

The background to UPOV is well documented. Before the introduction of IPRs in the Uruguay Round of Multilateral Trade Negotiations, IP protection was under the World Intellectual Property Organisation (WIPO). One of the treaties administered under WIPO and dealing specifically with plant genetic resources is the International Convention for the Protection of New Varieties of Plants (UPOV Convention).[245] The Convention's objective is to ensure that member states acknowledge inventions by plant breeders and reward them with exclusive rights over new plant varieties.[246] It establishes the concept of plant breeders' rights (PBRs).

The underlying principle of plant variety protection is in many ways similar to that of patent protection. The main reason for plant variety protection is cited as to 'serve as an incentive to development of agriculture, horticulture and forestry and to safeguard the interests of plant breeders.'[247] Recouping costs invested in breeding plant varieties as well as accumulating funds necessary for further investment is part of the justification for plant variety protection.[248]

Since its inception the UPOV Convention has been amended three times—in 1972, 1978 and 1991. Membership to the 1972 and 1978 Acts has been closed and any country wishing to join UPOV has only the option of the 1991 Act. The main operating Acts are those of 1978 and 1991.

There are substantial differences in the two versions of UPOV.[249] Under the 1978 Act, the breeder is entitled to protection, whatever the origin—artificial or natural, of the initial variation from which his variety is derived[250] that is, he is entitled to protection if he

[245] Signed in Paris in December 2 1961 and entered into force in 1968. The UPOV Convention has been revised three times: in 1972, 1978 and in 1991. See www.upov.int
[246] UPOV 1991 Act, article 2.
[247] UPOV, 'Why protect new varieties of plants?' Available at http://www.upov.int/eng/brief.htm
[248] Mugabe, J., *et al.* 'Managing access to genetic resources: national policy and legislative framework' in Mugabe, J. *et al.* (eds.) *Access to genetic resources: strategies for sharing benefits* (Nairobi: ACTS Press, 1997)
[249] See Watal, J., *Intellectual property rights in the WTO and developing countries* (London: Kluwer Law International, 2001) at 136-149 for detailed analysis on the differences and similarities. See also Verma, S., TRIPs and plant variety protection in developing countries *E.I.P.R.* 17/6 (1995) 281
[250] Article 4 of UPOV 1978 Act available at http://72.14.203.104/search?q=cache:h-mZEoSqqKEJ:www.upov.int/en/publications/conventions/1978/msword/act1978.doc+UPOV+1978+text&hl=en&gl=uk&ct=clnk&cd=5

"discovers" a new plant variety. Authorisation is needed from the plant breeder for the production for purposes of commercial marketing, the offering for sale, and the marketing of the reproductive or vegetative propagating material.[251] The 1978 Act however does not require prior authorisation from the plant breeder for research and creating of new varieties from his varieties and the marketing of those new varieties.[252] Member States are however free to grant more extensive rights to breeders, and especially to extend the protection to the marketed product.[253]

The 1991 Act broadens the scope of protection by widening the range of activities for which the authorisation of the plant breeder is required.[254] Unlike the 1978 Act, mere discovery is not enough; a breeder must have developed his discovery in order to secure protection. The protection of a variety derived from a protected variety is controversial and difficult to determine. Although the 1991 Act exempts obtaining of authorisation from the plant breeder for acts done privately, non-commercially and for experimental purposes, it requires authorisation for breeding and exploiting essentially derived varieties (EDVs). [255] Varieties whose production requires the repeated use of the protected variety e.g. as a parent for a hybrid variety, are said to be essentially derived. Under the 1991 Act, if a breeder makes some improvement over a protected variety he will have to seek permission from the holder of the original rights before marketing the new variety. The Act defines what constitutes a variety essentially derived from another.[256] The 1978 Act does not require such permission.
With regard to farmer's rights, the 1978 Act allows farmers to save seed or reproductive material of a protected variety for re-planting to produce a further crop. The 1991 Act provides for an optional exemption from breeders' rights: Article 15(2) allows contracting parties to provide an exception in favour of farmers that is 'within reasonable limits and subject to the safeguarding of the legitimate interests of the breeder.' Thus saving of seed is a farmer's right under the 1978 Act but only a privilege that may be granted subject to the terms in Article 15(2) under the 1991 Act.

[251] Id., article 5(1)
[252] Id., article 5(3)
[253] Id., article 5(4)
[254] Article 14 of the UPOV 1991 Act available at http://72.14.203.104/search?q=cache:VhMNFwIR75wJ:www.upov.int/en/publications/conventions/1991/msword/act1991.doc+UPOV+1978+text&hl=en&gl=uk&ct=clnk&cd=6
[255] Id., article 15(1)
[256] Id., article 14(5)b

Table 5.3: PVP under the UPOV Conventions, Kenyan & Indian domestic legislation

Particulars	UPOV 1978	UPOV 1991	Kenya	India
Scope of protection	May be applied to all genera & species but minimum requirement is 24genera & species within 8years	Varieties of all genera & species	Varieties of all genera & species	Genera & species listed with respect to new varieties and EDV s; extant varieties & farmers varieties as defined
Exclusion	None except as above	None, but subject to the public order, public health, etc	None	Non-listed genera & species with respect to new varieties & EDVs
Criteria	New, Distinct, Uniform & Stable	New, Distinct, Uniform & Stable	Distinct, Uniform, Stable & 'sufficiently varietal pure'	New, Distinct, Uniform & Stable for new varieties & EDVs, DUS for extant varieties, unclear for farmers' varieties
Disclosure	Description	Description	Description	Description & declaration
Nature and scope of rights	Prevent others from producing, marketing, & commercialising propagating materials including ornamental plants or parts	Prevent others from producing, reproducing, conditioning for propagation, offering for sale, selling, marketing, exporting, importing, or stocking for any of these purposes; under certain conditions, rights to extend to harvested material	Prevent others from producing, selling, marketing, exporting or stocking the protected variety; from propagating, selling parts or products of protected variety in special cases	Prevent others from producing, selling, marketing, distributing, importing or exporting the variety
Exemptions	For further breeding; for private & non commercial use; allows farmers to save seed or reproductive material of protected variety for re-planting	For further breeding, restricted in the case of EDVs; for private & non commercial use; for experimental use; farmers' privilege allowed within reasonable limits and subject to taking into account the legitimate interests of breeder; private and non commercial use; experimental purposes	For further breeding; for research purposes; no explicit reference to farmers' rights but generally, farmers allowed to save, use, exchange and share protected variety. Although sale is not explicitly prohibited, it is restricted by seed sellers registration and seed certification provisions	Exemption for breeding or experimental purposes but permission needed if protected variety is repeatedly used; Farmers' *rights* rather than privilege- allowed to save, use, exchange, share or **sell** protected variety but may not sell protected seed which is branded
Minimum Duration	15 years from grant, 18 years for trees & vines	20 years from grant, 25 years for trees & vines	15 years from grant, 18 years for trees & vines; extendable up to 25yrs	For new varieties, 6 yrs from registration (9 yrs for trees & vines); extendable up to 15yrs (18yrs for trees & vines)
Double protection	Not permitted	Permitted	Not permitted	Not permitted

Source: Louwaars et al (2005) with modifications; respective UPOV Conventions; Kenyan and Indian Acts of Parliament

The criteria for eligibility are the same under the two conventions. Varieties have to be distinct from existing commonly known varieties, sufficiently uniform, stable (the DUS test) and new in the sense that they must not have been commercialised prior to certain dates established by reference to the date of the application for protection.[257] Protection under the 1978 Act runs for at least15 years[258] and 20years in the case of the 1991 Act.[259]
The main differences between the two conventions are summarised in the table below which also shows where Kenya and India lie within this framework.

As at January 2009, UPOV had 67 members;[260] all of these have enacted national PVP legislation that is UPOV-compliant. Developing countries which joined UPOV at the time when membership to both Conventions was open joined the 1978 Convention rather than the 1991 Convention.[261] For some however, the domestic PVP law is more in line with the 1991 Convention although they are members of the 1978 Convention.[262] There are some developing countries with existing plant variety protection legislation that are not members of any of the UPOV conventions.[263] India lodged an application to join the 1978 UPOV Convention before membership to the 1978 Convention was closed; it is speculated that its membership will be denied given the state of its PVP law which is analysed later in this chapter.

5.1.3 The Food and Agriculture Organisation (FAO) International Treaty on Plant Genetic Resources

The FAO International Treaty (IT) is discussed below in the context of the provisions relevant to PPPs in agricultural research in developing countries. The FAO IT is important in the context of this thesis not in the least because it makes specific provision for genetic material held by the CGIAR Centres of which the host institutions to the two case studies, ICRISAT and ILRI, are part.

[257] Article 6 of the 1978 Act and article 5 of the 1991 Act
[258] 18 years for vines and trees
[259] 25 in respect of vines and trees
[260] See http://www.upov.int/en/about/members/pdf/pub423.pdf for an updated list of UPOV members
[261] However, as membership to the 1978 Convention is closed, developing countries wishing to join UPOV have only the option of joining the 1991Convention
[262] For example Kenya which currently aspires to 'upgrade' to UPOV 1991
[263] For example Tanzania and Indonesia

Unlike its predecessor, the International Undertaking on Plant Genetic Resources, the IT is legally binding. Its most unique feature is the establishment of a Multilateral System to facilitate access to plant genetic resources (PGRs).[264] The Multilateral System comprises a collection of 35 food and 29 feed crops to which member states are assured of 'facilitated access'. Member states are required to include all PGRs for food and agriculture (PGRFAs) of the 64 crops in the public domain. With regard to private collectors and 'all other holders' of PGRFAs of the 64 crops, member states are enjoined to encourage and invite the owners to include them in the Multilateral System. In addition, member states are required to put in place appropriate measures to facilitate this.[265] Although only 64 crops are covered, and even then, only for the purpose of food and agriculture, these crops account for about 80% of the world's total calorie intake from plants.

The FAO International Treaty and CG Centres

The FAO International Treaty (IT or Treaty) is a unique treaty particularly because of its involvement of 'non state' actors. Under basic international law theories, international conventions, treaties and agreements apply only to sovereign national states. International Agriculture Research Centres including those under the CG system are required to sign agreements with the Treaty's Governing Body making them *de facto* 'members' of the Treaty. This establishes a direct link between the Treaty and the Centres in a way that is distinctly different from the indirect relationship that non state actors have with international treaties which by their nature have to be 'mediated' by national governments within which the non state actors reside. In the latter more common scenario, non state actors are obliged to abide by international treaty provisions only to the extent that these are implemented into national laws which then prescribe the manner in which the non state actors are bound.

This unique relationship between the CG Centres and the Treaty makes the latter the most relevant and direct international IP regime of the three (TRIPs, UPOV and the Treaty). In so far as CG Centres are obliged to use standard material transfer agreements for the acquisition and transfer of PGRFAs (as prescribed by the Treaty) the CG Centres'-Treaty relationship requires no medium and is thus direct and binding.

[264] Under article 11
[265] Article 11(3)

Table 5.4: Membership to agriculture-related IP international instruments

International instrument	**Kenya** ratified/acceded	**India** ratified/acceded	**ILRI**	**ICRISAT**
Patent Cooperation Treaty	June 1994	December 1998	Not applicable	Not applicable
WTO/TRIPs	January 1995	January 1995	N/A	N/A
CBD	1994	1994	N/A	N/A
UPOV 1978	May 1998	Applied to join	N/A	N/A
FAO ITPGR	2003	2002	June 2006	June 2006

5.2 Kenya's IP framework relevant to agricultural R&D

Legislation in IP in Kenya was a colonial heritage. Sijthoff argues that IP law was introduced to advance general imperialist interests at the time; he supports his argument by pointing out the low levels of literacy, technological advancement and innovation among the natives.[266]

Although the first registered patent in Kenya dates as far back as 1932, Kenya had no independent patent protection system until 1989. The Patents Registration Act required the applicant to have been a grantee of a patent in the UK or derive his right from a grantee of a patent in the UK.

The National Council for Science and Technology and the Legal and Patents Committee were mandated to draw up guidelines on an appropriate patent system for Kenya and make recommendations on a national patenting policy formulation and implementation. The Committee findings included providing for the training of personnel and infrastructure for carrying out patent examinations and processing applications. The Industrial Property Act Cap 509 was thus enacted in 1989 to replace the Patent Registration Act. It came into force in 1990. The Act was amended a number of times and was finally replaced by the Industrial Property Act No. 3 of 2001 which ensured conformity with the TRIPs Agreement.

5.2.1 Protection of agricultural biotechnology inventions

The Industrial Property Act (IPA) is the primary statute governing patents and other industrial properties. It incorporates both the necessary minimum standards and the allowable flexibilities of the TRIPs agreement. The preamble states the objective of the Act is "to provide for the promotion of inventive and innovative activities, to facilitate the acquisition

[266] Sijthoff, L., *Design protection* (London: Butterworths, 1976)

of technology through the grant and regulation of patents, utility models, technovations and industrial designs, to provide for the establishment, powers and functions of the Kenya Industrial Property Institute…"

Patentable subject matter

The IPA provides for the patentability of both products and process inventions[267] that are new, involve an inventive step and are industrially applicable or are 'a new use'.[268] This inclusion of 'a new use' seems to use a broad definition that is more in line with the 'no exceptions' category in the schema developed above. Sections 23, 24 and 25 define what constitutes novelty, inventive step and industrial application respectively. The Act excludes from patentability:

> "discoveries, scientific theories and mathematical methods; schemes, rules or methods for doing business, performing purely mental acts or playing games; methods for treatment of the human or animal body by surgery or therapy, as well as diagnostic methods practised in relation thereto, except products for use in any such methods; mere presentation of information; and Public Health related methods of use or uses of any molecule or other substances whatsoever used for the prevention or treatment of any disease which the Minister responsible for matters relating to health may designate as a serious health hazard or as a life threatening disease."[269]

The IPA declares that plant varieties are not patentable although "parts thereof or products of biotechnological process" may be patentable.[270] This provision would fit in the 'some exceptions' category in the options discussed above. Inventions contrary to public order, morality, public health and safety, principles of humanity, environmental conservation are also excluded from patentability.[271]

The IPA requires Kenyan residents to file a patent application in Kenya prior to filing a patent application in respect of the same invention abroad. Contravening this requirement

[267] Section 21(2)
[268] Section 22
[269] Section 21(3)(a)-(e)
[270] Section 26(a)
[271] Section 26(b)

renders an applicant liable on conviction to a fine and/or term of imprisonment. Written authority is required where an applicant wishes to file a patent application abroad prior to the lapse of six months from the date the application for the same invention was filed in Kenya.[272]

On patents relating to living matter, where a micro-organism has been used in a process or produce and is not available to the public and cannot be described in the patent application so as to enable the invention to be carried out by a person skilled in the art, section 29(1)(a) requires that a culture of the micro-organism be deposited with a depository institution. Applicants must disclose the origin of material used in the invention. This is aimed at curbing biopiracy. Some high profile cases have been highlighted in the media.[273] This is resonant with the spirit underlying an 'all exceptions' option.

Scope of rights

Part VII of the IPA covers the rights and obligations of the applicant or the owner of the invention. The patent holder has the right to preclude any person from exploiting the protected invention whether a product or process by making, importing, offering for sale, selling and using the product; or stocking such product for the purposes of offering it for sale, selling or using it.[274]

The patent holder's rights however extend only to acts done for commercial or industrial purposes and not to acts done for scientific research.[275] The IPA allows for parallel importation by limiting the patent rights 'in respect of articles put on the market in Kenya or in any other country or imported into Kenya.'[276] This was to address the controversy relating to the lack of access to essential drugs.[277] This provision has however never been invoked.

[272] Section 28

[273] For example Sheridan, C., Kenyan dispute illuminates bioprospecting difficulties, *Nature*, 8 November (2004) on the Kenya Wildlife Service case against Genencor International Inc. over micro-organisms extracted from Kenyan lakes which are used for processing jeans and making detergents; it is debatable whether the requirement to disclose the origin of material in patent applications filed in Kenya staves off biopiracy as majority of the 'bioprospectors' do not file applications in Kenya. The media has proved to be an effective medium of deterrent as was the case in a collaborative HIV research project between Kenyan and University of Oxford scientists; 'Kenya sues British AIDS team for theft' *The Daily Nation* 5 June (2004)

[274] Section 54

[275] Section 58(1)

[276] Section 58(2)

[277] Kameri-Mbote, P., Intellectual property protection in Africa: an assessment of the status of laws, research and policy analysis on intellectual property rights in Kenya (Nairobi: ACTS Press, 2004)

Duration

The length of a patent is 20 years from the filing date of the application.[278] The regulations prescribe the amount to be paid as annual fees; if the annual fee is not paid, the application or patent is deemed to have been withdrawn and is published as such.

Part X covers contractual licences and provides for *inter alia* the rights and obligations of licensees and licensors, forms of licence contracts, prohibited terms in licence contracts, procedure for registration of the contract, issue of certificates and compulsory licences. The Act also covers other forms of industrial property such as utility models, industrial designs and technovations.

Biosafety

The National Biotechnology Development Policy was adopted in 2006 to guide the research, development and trade in biotechnology products. Although the protection of agricultural biotechnology inventions falls under the IPA, the Biosafety Act regulates modern biotechnology research and related biosafety matters. Any research on and use of biotechnology in Kenya must receive the approval of the National Biosafety Authority established under section 5 of the Act.

Activities requiring the approval of the Authority include contained use, introduction to the environment, placing in the market, transit or import of genetically modified organisms.[279]

Noticeably, the Act states that its provisions do not apply to GMOs that are pharmaceutical for human use;[280] thereby failing to set out the fate of the regulation of these GMOs leading to comments that they are not regulated at all.[281]

5.2.2 Plant Variety Protection in Kenya

At the time Kenya joined the WTO in 1995, the Seeds and Plant Varieties Act of 1972 was already in place and already provided for the protection of plant varieties. On a technical

[278] Section 60
[279] Section 14(a)-(e)
[280] Section 3(2)
[281] African Centre for Biosafety, Comment on the Republic of Kenya's Biosafety Bill (Richmond: African Centre for Biosafety, 2007)

level therefore, Kenya did not have to do anything to implement TRIPs Article 27(3)(b) on accession to the WTO. The then Industrial Property Act and the Seed and Plant Varieties Act embodied the spirit and intent of Article 27(3)(b).

Kenya acceded to the 1978 UPOV Convention in 1999. The Statute Miscellaneous Amendment Bill of 2000 domesticated the UPOV provisions in Kenya.

Protectable subject matter

The Industrial Property Act stipulates that plant varieties as provided for in the Seeds and Plant Varieties Act (but not parts thereof or products of biotechnological processes) are not patentable. [282] As it allows parts of plants to be patentable, it clearly adopts the 'some exceptions' option.

Plant variety protection in Kenya is provided for under the Seeds and Plant Variety Act (SPVA). The preamble outlines the SPVA's objectives as including provision for the testing and certification of seeds, the establishment of an index of names of plant varieties, and provision for the grant of proprietary rights to breeders.

Criteria for grant of PBRs

The Fourth Schedule to the Act specifies the criteria for the grant of PBRs. These are the traditional 'substantially distinguishable', 'sufficiently uniform' and 'stable'. In addition to this, the Schedule adds that the plant variety must be pure.[283] A variety must also be new; it is considered new if the propagating material, whole plant or harvested material of it has not been sold or offered for sale with the agreement of the owner in Kenya for more than 1 year prior to the date of application or outside Kenya for more than 6 years (prior to the application date) in the case of woody plants or more than 4 years for non-woody plants.

An applicant must propose a denomination for the new variety to enable the variety to be recognised. Failure to provide one or if the proposed denomination is unacceptable the applicant is required to propose one or provide an alternative as the case may be.

[282] section 26(a)
[283] Fourth Schedule, Part II, section 1

Nature of PBRs

The breeder has rights to control the reproduction, commercialisation, sale and stocking of the protected variety:

> "…the holder of plant breeder's rights in a plant variety shall have the exclusive right to do, and to authorise others to do, the following—produce reproductive material of the variety for commercial purposes, to commercialise it, to offer it for sale, to export it, to stock it for any of these purposes and to have any or all of their activities performed."[284]

This provision extends beyond that under UPOV 1978 as it includes restrictions on exportation and stocking but falls short of the scope of protection provided by the 1991 Convention. PBRs are currently available for varieties of any kind of plant other than algae and bacteria. PBRs are granted for a minimum 18 years in the case of trees and vines and 15 years for all other plant varieties.[285] Protection for all may be extended for up to 25 years.

Exemptions to breeder's rights

Where production and stocking for production is concerned, protected varieties may be used for research purposes or for developing new varieties in the breeder's nursery.[286] Similar to the 1978 Convention, private non-commercial use of protected varieties is permitted.

There is no explicit reference to farmers' right to save seed. Seed saving is in practice allowed although seed sale is restricted by certification requirements. Farmers are free to grow or use a protected variety for non-commercial purposes, use the plants or parts of the protected variety for human consumption, non-propagating purposes and for plant breeding. Farmers may therefore be able to save exchange and re-use protected seed but may not offer it for sale to others. Seed offered for sale must be certified and a seed seller must obtain a seed seller's licence under the Seeds and Plant Varieties (Seeds) Regulations.[287] Seed sellers renew their licence annually; non-renewal of licence for two consecutive years renders the

[284] Section 20; the Fifth Schedule grants further rights in special cases such as the sale of cut blooms & fruits.
[285] Section 19
[286] Section 20(1)
[287] Sections 17 & 18

seed seller's operational status as ceased.[288] Read as a whole, the SPVA provisions on farmers' rights are midway between 1978 and 1991 Conventions in that although they do not restrict seed saving, the SPVA is reluctant to grant farmers far reaching privileges.

[288] 'Government threatens to deregister companies that have failed to renew licenses' *The East African Standard*, 13 February (2005) available at http://www.eastandard.net/archives/?mnu=details&id=13050&catid=14

Table 5.5: Other summarised provisions on agricultural biotechnology and PVP

		Administration	Enforcement
Kenya	**Biotech**	The Kenya Industrial Property Institute (KIPI) is an examining office and is under the Ministry of Trade & Industry administers IPA; KIPI is run by a Board of Directors whose membership comprises stakeholders from various sectors. KIPI MD is responsible for the day to day management of the institute.	IPA defines infringement and provides for relief by through e.g. injunction & damages;Intentional infringement of a patent constitutes an offence which is punishable by a fine or with imprisonment or both.Appeals from MD's decisions lie with Industrial Property Tribunal
	PVP	The Kenya Plant Health Inspectorate Service (KEPHIS) administers PBRs Functions include granting and administering of PBRs, maintaining the PBR register, variety DUS testing (over two growing seasons), seed certification, quarantine control, conducting searches on protected varieties at UPOV level Where KEPHIS lacks the requisite capacity to conduct variety testing, e.g. in horticultural and ornamental varieties, it adopts results of tests from other PVP offices under UPOV	Infringements of PBRs are actionable on the suit of the holder. PVP offices are not actively engaged in enforcement. There have not yet been any major disputes on PVP brought before the courts save for perhaps one case where a small seed company's right to market seed of a KARI maize hybrid was contested. SPVA establishes the Seeds and Plants Tribunal which hears appeals on decisions regarding e.g. PBRs Appeals on decisions made by the Tribunal on a point of law lie in the High Court
India	**Biotech**	Controller of Patents administers the IPA and has wide powers e.g. acting as a civil court. Currently, there are four examining patent offices located in Kolkata, Mumbai, Chennai and Delhi that deal with applications for patents originating within their respective territorial jurisdictions. The IPA specifies the matters that shall lie on appeal to the Appellate Board established under the Trade Marks Act. No court or other authority shall have jurisdiction, powers or authority in relation to those matters specified as falling under the jurisdiction of the Appellate Board.	The Indian courts have been active in interpreting legislation on IP and have displayed an inclination to create new case law where there has been an absence of statutory rules.e.g. *Emergent Genetics India Pvt Ltd v Shailendra Shivam & others* (Suit no. 50 of 2004) where copyright was claimed in the unique DNA sequence of a hybrid variety of cotton seeds. In *Novartis AG & another v Adarsh Pharma & another* (2004 (29) PTC 108 (Mad)), the court distinguished between patents and Exclusive Marketing Rights (EMRs)
	PVP	The PPV&FRA establishes the Protection of Plant Varieties and Farmers' Rights Authority and the Registrar who both have vast powers e.g. 'all the powers of a civil court…' and may make orders which are executable as a decree of a civil court. All applications for PBRs are made to the Registrar established under the Act. The Act innovatively establishes a National Gene Fund whose functions include collecting benefit sharing received from breeders, propagating material received from breeders, annual fees payable to the Authority, compensation from breeders and contributions from national and international organisations and other sources. The Fund is used to make payments under the benefit sharing provisions, compensation, conservation related expenditures, etc	All suits for infringements are instituted in any court inferior to a District court having jurisdiction to try the suit. Infringement of rights attracts both civil and criminal sanctions; the burden of proof is upon the defendant or accused person to prove his innocence The Act establishes the Plant Varieties Protection Appellate Tribunal which entertains appeals from orders or decisions made by the Authority or the Registrar

5.3 India's IP framework relevant to agricultural R&D

Protection of IP in India dates as far back as the 16th and 17th centuries with the establishment of commercial and, later, colonial interests by the Portuguese, Dutch, French and British. In 1856, the Act of Protection of Inventions which was based on the British Patent Law of 1852 was passed. The Patents and Designs Protection Act of 1872 and the Protection of Inventions Act of 1883 were consolidated into the Invention and Designs Act in 1888 which, together with the Indian Patents and Designs Act of 1911, comprised the pre-independence IP legislation.[289]

5.3.1 Protection of agricultural biotechnology inventions

After independence, a Patents Bill was introduced into parliament and was enacted as the Indian Patents Act of 1970. The Indian Patents Act has undergone numerous amendments in 1999, 2002, 2004 and 2005. The Act contains no explicit mention of biotechnology.

Patentable subject matter

The Indian Patents Act defines an invention as a new product or process involving an inventive step and capable of industrial application. It further defines what constitutes an inventive step. The Act uses an 'exclusion' style by listing what is *not* patentable as opposed to what is patentable under the Act. Section 3 lists as unpatentable *inter alia*, a frivolous invention, mere discovery of a scientific principle or formulation of an abstract theory or discovery of any living thing or non-living thing substances, mere discovery of a new form of a known substance which does not result in the enhancement of the known efficacy of the substance or the mere discovery of any new property or new use for a known substance or of the mere use of a known process, machine or apparatus 'unless such known process results in a new product or employs at least one new reactant', mere arrangement or re-arrangement or duplication of known devices each functioning independently of one another in a known way, among others including the usual diagnostic, therapeutic or treatment methods, mathematical or business method and presentation of information.

[289] Bose, D., Sen, S. & Subbarayappa, B., *A concise history of science* (New Delhi: Indian National Science Academy, 1971)

On biotechnology inventions, micro organisms are patentable but plants and animals in whole or part, seeds, plant varieties and species and essentially biological processes are not patentable: "plants and animals in whole or any part thereof other than micro-organisms but including seeds, varieties and species and essentially biological processes for production or propagation of plants and animals;"[290] are not inventions within the meaning of the Act. This seems to adopt the 'all exceptions' option.

The Patent Act does not list non-biological processes, microbiological processes, non-essential biological processes for the production of plants or animals, essentially biological processes for the production of micro-organisms and macro-organisms other than plants and animals or macro-organisms other than plants and animals as excluded from patenting. These must therefore be understood to be patentable under the Indian Patent Act.[291] By permitting these to be patentable, the Patent Act seems to be a variant of the 'some exceptions' option.

Prior to the 2002 amendment, processes for 'medical, surgical, creative, prophylactic or other treatment' of animals and plants to render them 'free of disease or to increase their economic value or that of their products' were excluded from patenting. In the 2002 amendment, 'plants' was deleted the effect being that a method or process of modification of a plant is patentable. Taken together with section 3(j), this means that genetically modified seeds can be patented as can non essentially biological processes for their production.

Significantly, section 3(p) lists as not patentable an invention which is in effect traditional knowledge or which is an aggregation or duplication of known properties of traditionally known components. This section reflects the lessons learnt from India's experiences with bio prospectors and from generations of traditional knowledge practitioners.

Scope of rights

The Indian Patents Act spells out the rights conferred by a patent: the patent holder has the exclusive right to prevent third parties who do not have his consent from making, using, offering for sale, selling or importing for these purposes the product or product obtained

[290] Section 3(j)

[291] This was introduced by the 2002 amendment prior to which microbiological processes were not patentable. However, such inventions had sometimes been granted patents such as the broad patent granted to Agracetus, a U.S. company on genetically engineered cotton cells and lines. The patent was later revoked due to public outcry; see Bijman, J., Agracetus: patenting all transgenic cotton, *Biotechnology and Development Monitor* 21 (1994) 8

directly by the patented process.[292] Co-owners of a patent have equal rights unless an agreement to the contrary is in force. An exception to the patentee's rights for experiment, research or educational purposes is permitted under the Act.[293]

Duration

The duration of the protection is 20 years from the date of filing the patent application. Where the patent renewal fee is not paid within the prescribed period, the patent ceases to have effect. On the cessation due to non-payment of the renewal fee or on expiry of the term of patent, the subject matter covered by the patent shall not be entitled to any protection.[294] In the former case however, an application for the restoration of a lapsed patent may be made to the Controller detailing the circumstances which led to the failure to pay the prescribed fee.[295]

5.3.2 Plant Variety Protection in India

Efforts to develop a plant variety protection system were underway in India before the TRIPs Agreement; TRIPs therefore offered the momentum to the process rather than the *raison d'être*. Seshia offers a comprehensive discussion of the interplay between on one hand, the international framework, domestic law making processes and the political economy of PVP, and on the other hand, the agency of actors that was responsible for the drafting and the content of the current Protection of Plant Varieties and Farmers' Rights Act (hereinafter the PPV&FRA) of 2001.[296]

India's policy on IPRs was largely governed by the notion of free access; the obligation to provide for PBRs in order to be TRIPs compliant had to be balanced against ensuring access to PGRs and protecting farmers' interests in order to reflect the underlying tenet. Prior to the seed policy reform in the 1980s, the role of private seed companies in agriculture was restricted. Under the Seed Policy adopted in 1988, the government liberalised the importation

[292] Section 48
[293] Section 47(3)
[294] Section 54(4)
[295] Section 60
[296] Seshia, S., Plant variety protection and farmers' rights in India: law-making and the cultivation of varietal control, *Economic and Political Weekly* 37/22 (2002) 2741

of seed including hybrid seed for a number of important crops. This spurred the growth of private seed companies in India which were instrumental in advocating for PVP.[297]

The PPV&FRA was enacted in 2001 after almost a decade of negotiations. The multiplicity of the stakeholders involved in the decade of negotiations is borne out by the content of the final Act. The Act is unique in that it attempts the hitherto unchartered balance of conflicting and divergent interests of plant breeders, farmers, and communities; it provides for strong protection of rights for all quarters. The history of negotiations leading to enactment of the PPV&FRA is reflected in the UPOV-plus protection of plant varieties and the FAO IT-plus protection of farmers' rights. The resulting Act was welcomed by virtually all stakeholders; for those representing farmers' and communities' rights, the Act met their demands by acknowledging farmers and communities as breeders and according their breeding efforts the right to protection as it did that from commercial breeders. The seed industry's acceptance of the broad protection of farmers' rights was perhaps influenced by the view that farmers' rights seen in the light of ownership would reinforce the IPR system.

Protectable subject matter

The Act commences with a preamble stating its potentially conflicting objectives: the protection of the rights of farmers for the contribution in conserving, improving and making available PGRs for the development of new plant varieties; and the protection of PBRs in order to stimulate investment in R&D in both the public and private sectors and to facilitate the growth of the seed industry. The preamble also states that the PPV&FRA gives effect to TRIPs article 27(3)(b).

The Act provides for protection of four categories of plant varieties: new varieties, essentially derived varieties; extant varieties and farmers' varieties.[298] Ramanna and Smale posit that this classification can be correlated with the interests of the specific stakeholders 'or the means of variety protection which would most likely benefit each.'[299] The Act defines extant varieties and farmers' varieties. The latter are varieties which have been traditionally cultivated and evolved by the farmers or varieties which are wild relatives or land races of a variety about

[297] Pray, C. & Kelly, T., *Impact of liberalisation and deregulation on technology supply by the Indian seed industry* (Washington DC: World Bank, 1997) whose empirical study showed that the liberalisation and the development of hybrids had a positive impact on private R&D in the seed sector

[298] Section 14

[299] Ramanna, A. & Smale, M., Rights and access to plant genetic resources under India's new law, *Development Policy Review* 22/4 (2004) 423 at p429

which farmers possess the common knowledge. Essentially derived varieties (EDVs) are also protectable under the Act; the definition of these is similar to that found in UPOV 1991. In terms of farmers' rights, the Act is to the extreme left of the 1978 UPOV Convention while in terms of protection of new varieties and EDVs, the Act is more in line with the 1991 Convention.

Ramanna argues that the four types of protectable varieties correspond to the interests of the various stakeholders involved in the negotiations: new varieties mainly benefit the private sector; extant varieties are most likely to be protected by the public sector, community associations and farmers, EDVs likewise benefit the public sector, community associations and farmers while farmers' varieties are mostly relevant for individual farmers and farmers' associations.[300] Section 16 allows any breeder, his assignee, successor or any authorised person, farmer or group of farmers or community of farmers, university or public institution claiming to be the breeder, to apply for the protection of any type of variety.

Section 29(2) states that the 'Central Government shall… specify the genera or species for the purposes of registration of varieties other than extant varieties and farmers' varieties' under the Act. This means that EDVs and new varieties for which protection is sought must fall within the specified list while extant and farmers' varieties with respect to which registration is applied need not be under the specified list and can therefore be for any genera or species.

Criteria for grant of PBRs

The PPV&FRA seems to have different criteria for the grant of PBRs for the different categories of protectable varieties. For new varieties and EDVs, the Act prescribes the usual NDUS criteria.[301] Extant varieties need not fulfil the novelty criterion; the DUS criteria is as specified under regulations made by the Protection of Plant Varieties and Farmers' Rights Authority established under the Act.[302] The criteria for protection of farmers' varieties are unclear.

[300] Ramanna, A., 'India's plant variety and farmers' rights legislation: potential impact on stakeholder access to genetic resources' EPTD Discussion Paper no. 96 (Washington D.C.: International Food Policy Research Institute, 2003)
[301] Section 15(1) and 23(7) respectively
[302] Section 15(2)

In all cases, applicants must assign a single and distinct denomination to a variety with respect to which protection is sought.[303] The Act lists the requirements that the denomination has to meet in order to be accepted.

Duration

The minimum length of protection accorded (for new varieties) by the Act is 9 years for trees and vines and 6 years for all other crops. This may be reviewed and renewed on payment of prescribed fees for a period of up to 18 years in the case of trees and vines and 15 years for all other crops from the date of registration of the variety. All other categories of protectable varieties can only be renewed for a period of up to 15 years from the date of notification of that variety by the Central Government under the Seeds Act.[304] This provision falls short of the 1991 Convention and would meet the duration of protection requirement under the 1978 Convention only if the maximum allowable protection period is exercised.

Scope of rights

PBRs are conferred on the issuance of a certificate of registration. The right holder, his successor, agent or licensee has the exclusive right to 'produce, sell, market, distribute, import or export the variety'.[305] These rights go beyond those prescribed by UPOV 1978. For extant varieties, unless a breeder or his successor establishes his right, the Central Government or the State Government shall be deemed to be the owner of the right granted in respect of the extant variety.[306]

For EDVs, the right holder has the same rights although he requires the authorisation of the breeder of the initial variety; such authorisation may be subject to such terms and conditions as both parties may mutually agree upon.[307] Where the initial variety is a farmers' variety, authorisation must be with the consent of the farmers or group of farmers or community of farmers who have made contribution in the preservation or development of such variety.[308] The Act is silent on how this is to be determined.

[303] Section 17(1)
[304] Section 24(6)
[305] Section 28(1)
[306] Section 28(1)
[307] Section 23(6)
[308] Section 43

Farmers' Rights

Under UPOV 1991, farmers' privilege is seen as an exception to plant breeders' rights. The most unique feature of the PPV&FRA is that it recognises farmers as breeders whose efforts are worthy of protection. A farmer is defined as one who engages in crop cultivation or in conserving and preserving traditional crop varieties or wild species of crops and selecting them for their useful properties.[309] The Act therefore recognises the farmer as cultivator, conserver and breeder. It establishes farmers' *rights* demonstrating a major conceptual shift from farmers' *privilege*. It also shows an extension of the private property construct developed for new varieties into the sphere of communal and traditional knowledge. This concept of farmers' rights is however not without its critics. Asking if rights should be 'reduced to a mere compensation mechanism', Swaminathan argues that farmers' rights as contained in the Act are not a judicial concept but a mechanism to ensure compensation.[310]

Farmers' rights under the PPV&FRA are extensive; a farmer is entitled to save, sow, re-sow, exchange, share or even *sell* his farm produce including seed of a variety protected under the Act in the same manner as he was before the Act's entry into force. The restrictions on his rights extend only to selling branded seed of a protected variety. Branded seed is defined as 'any seed put in a package or any other container and labelled' in a manner indicating that such seed is of a protected variety.[311] Other incidental rights include farmers' rights to register traditional varieties, farmers' right to benefit sharing, and farmers' right to get compensation for undisclosed use of traditional varieties. Similar to the concept of farmers' rights under the ITPGR, the Act provides for farmers' rights for reward and recognition.[312]

In addition to these novel rights, a farmer is entitled to compensation from a breeder (through the established National Gene Fund) where the latter provides propagating material that fails to provide the stipulated performance.[313] In proceedings before the Authority, the Registrar, the Tribunal or the High Court, a farmer or group of farmers are not liable to pay any fee for the inspection of documents or for obtaining a copy of any decision.[314] Farmers are also protected against innocent infringement.[315]

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[309] Section 2(k)
[310] Swaminathan, M., *Agrobiodiversity and farmers' rights* (New Delhi: Konark Publishers, 1996)
[311] Section 39(1)(iv)
[312] Section 39(1)(iii)
[313] Section 39(2)
[314] Section 44
[315] Section 42

Notwithstanding its overt reference to the farming community, it is unlikely that the farming community will enjoy the full benefits of the Act's provisions. Firstly, the criteria for protection of farmers' varieties are unclear. The usual NDUS criteria are unsuitable for farmers' varieties and beneficial only to commercial breeders.[316] It is also probable that the Act is likely to benefit large private seed companies more than it would the public sector or the small scale seed industry.

All PBRs must be maintained by a fee paid annually by every breeder, agent or licensee. The fee is determined on the 'basis of benefit or royalty gained by such breeder, agent or licensee' in respect of the variety.[317] Failure to pay the fee for two consecutive years renders the registration forfeited.

Researchers' Rights

Similar to both Conventions, the PPV&FRA provides for the use of protected varieties by any person for the purpose of conducting research or experimentation. Noticeably, the Act uses the term 'researchers' rights' rather than the UPOV 'exception to the breeders' rights'. The use of a protected variety as an initial source of variety for the purpose of creating other varieties is also permitted. The researcher however has to obtain the authorisation of the breeder of the protected variety where the repeated use of the protected variety is necessary for commercial production of the newly developed variety.[318] This provision is similar to that under the 1978 UPOV convention.

Subsection conclusion

National IP laws are undoubtedly shaped by the international IP regime. Both Kenya and India have not taken full advantage of the flexibilities under the TRIPs Agreement e.g. through appropriate definition of terms such as 'micro-organism' and 'essentially biological' and 'non-biological' processes. The two countries have implemented the TRIPs provisions differently although both are TRIPs-compliant. Using the options schema developed, both countries have adopted the 'some exceptions' option.

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[316] Dutfield, G., *Intellectual property rights, trade and biodiversity: seeds and plant varieties* (London: Earthscan, 2000) who points out that local communities are unable to acquire PVP due to the intra-varietal genetic diversity of the traditional cultivars and land races that they cultivate.
[317] Section 35(1)
[318] Section 30

With regard to PVP, Kenya lies between the 1978 and 1991 Conventions; some provisions go beyond the protection accorded under the 1978 Act but fall short of the 1991 Convention while others are more in line with the latter Convention. India's provisions on PVP are mixed: with regard to farmers' rights, the PPV&FRA offers greater protection than that allowable under the 1978 Convention; the Act provides for protection of extant varieties which are not protectable under either Convention; on new varieties, the Act's provisions are similar to those under the 1991 Convention in many respects.

5.4 Impact of IP on agricultural R&D

Having discussed the international IP regime and how this is implemented in Kenya and India, this section now looks at the operational impact of IP protection on agriculture research i.e. how IP legislation affects the conduct of research in agricultural biotechnology and plant breeding in a food security PPP context. Given the dearth of research, the analysis in this section is limited to the implications that can be drawn using the data available.

Biotechnology applications and grants in Kenya

Since receipt of the first patent application in 1991, KIPI had received 459 local and foreign patent applications by September 2005. 260 of these were granted while 100 were rejected; the rest were either pending, withdrawn or their examination abandoned.[319] KIPI had also received about 330 PCT applications and over 3300 applications through the African Regional Intellectual Property Organisation.

KIPI does not use the International Patent Classification; it is therefore difficult to establish which of the patent applications relate to biotech generally and agricultural biotechnology specifically.

The IPA and the IPA Regulations of 2002 set the patent application and other related fees. Although a distinction is made between local and foreign applications, the fees schedule does not discriminate between individuals and corporations or between small, medium and large

[319] Kenya Industrial Property Institute, pers. comm. (2005)

companies. An individual local inventor pays the same fees as a local company although in the context of agriculture biotechnology it is unlikely that applicants would be individuals.

With regard to PBRs, the same amount of fees is payable by all applicants in respect of the various categories. No distinction is made regarding residence and type of applicant so that a local individual breeder pays the same fees as a foreign multinational corporation. It is interesting to note that applications for PBRs (US$200) cost more than for patents (US$ 150 for foreigners and about US$40 for local inventors).

PVP applications and grants in Kenya

By September 2005, KEPHIS had received a total of 671 PVP applications. These are summarised in the table below.

Table 5.6: PVP applications received by KEPHIS as at September 2005

crop type	source of application				**total applications**	Share of category (%)	Share of total (%)
	foreign	Kenya public	Kenya private	joint public & private			
'other' crops							
cereals	0	41	22	48	**111**	39	17
oil seeds	14	17	5	0	**36**	13	5
industrials	0	54	29	0	**83**	29	12
pulses	7	20	6	6	**39**	14	6
root crops	0	13	0	2	**15**	5	2
pasture grasses	0	11	1	0	**12**	4	2
total 'other'	21	145	62	56	**284**	100	42
share of 'other' (%)	7	51	22	20	**100**		
horticultural crops							
ornamentals	346	0	7	5	**358**	93	53
vegetables	15	2	5	0	**22**	6	3
fruit	5	2	0	0	**7**	2	1
total hort.	366	4	12	5	**387**	100	58
share of hort. (%)	95	1	3	1	**100**		
total	**387**	**149**	**74**	**61**	**671**		
share of total (%)	58	22	11	9	100		

Source: compiled by author based on information provided by KEPHIS

Foreign applications make up 58% of total applications. 78% of foreign applications are from Netherlands and Germany who are prominent in the Kenyan horticultural industry. Most of the PVP applications are for horticultural crops with ornamentals comprising 95% of

horticultural crops. Within ornamentals there are 281 applications for roses making them the crop most protected by PBRs; roses make up 41% of the entire PVP applications. Domestic applications barely make any inroads in PVP applications for horticultural crops; foreign enterprises make up 95% of all horticultural PVP applications.

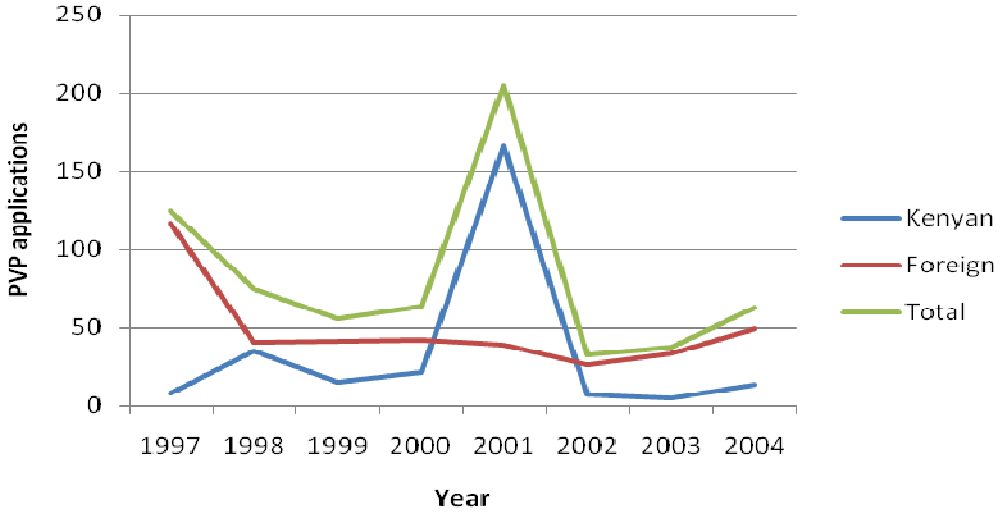
The public sector is the most dominant sector in seeking PVP applications for crops other than horticultural crops. Applications in this broad category are mainly from cereals (39%), industrial crops (29%), pulses (14%) and oil seeds (13%). Foreign applications make up only 7% of crops other than horticultural crops.

In 2001, a decision was made to provide an amnesty to protect extant public varieties allowing them to be eligible for a full term of protection. This occasioned a great increase in PVP applications for public varieties. However, the provision was highly controversial and was yet to be gazetted as of September 2005; only 150 of the 671 PVP applications had been granted. The sharp decline in foreign applications witnessed between 1997 and 1998 was a result of the stabilisation of the initial rush to seek protection on the implementation of the Act in 1997.

From the information collected during the interviews, PVP in Kenya seems to have had a number of impacts; firstly, KEPHIS officials recorded an increase in the number and range of improved varieties available to farmers after introduction of PVP. Maize was particularly highlighted as being of superior quality after introduction of PVP. Secondly, according to KEPHIS and some interviewees in the horticultural industry, there is enhanced access to foreign-bred materials; foreigners account for 58% of all PVP applications which indicates enhanced availability of foreign germplasm. However, having better access to foreign varieties does not mean that the exploitation opportunities improve as well. The issue of access of local breeders and farmers to these varieties is unclear.

Thirdly, there has been increased investment in breeding and commercialisation of new varieties. This is mainly in physical facilities and use of advanced technology in the private sector which stands in contrast to investment in public institutions. It is unclear however, if this is a product of PVP or of the general policy and economic environment

Figure 5.1: Annual trend in PVP applications in Kenya (1998-2004)



Source: compiled by author based on information provided by KEPHIS

Fourthly, the officials noted increased collaboration between local breeders and foreign breeders and international institutions. This was mainly on capacity building, germplasm exchange and commercialisation of foreign varieties in Kenya. Local breeders were noted to have also extended partnerships with farmers for on-farm testing of newly bred varieties. Again, although KEPHIS cited this as a product of PVP, it is more likely to be due to the general agricultural policy and economic environment.

Fifthly, 58% of PVP applications are for ornamental varieties some of which are commercially produced in the country for export. Export of horticultural produce is the third largest source of foreign exchange. The horticultural industry is also a significant source of local employment.

Of most concern, the PVP system offers greater support to the cash crop than food crop sector. The PVP system seems to have benefited from the capital-intensive sectors of Kenyan agriculture. It is evident that the law has not had much effect on food security; over four-fifths of all PVP applications are for cash crops. Implications of this trend with regard to national food security objectives are worrying.

Although most of these impacts as cited by the interviewees seem positive, the issue of access to protected varieties by local farmers has not been factored in. No useful information was available regarding the cost of protected seed and the overall effect on yield compared to non

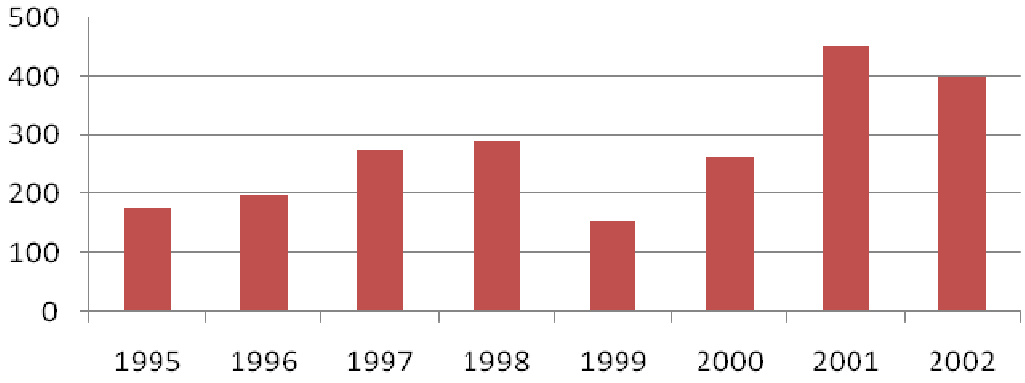
protected varieties. Furthermore, some of these seemingly positive impacts relate more to the economic and social impact of the horticultural industry as a whole rather than that of PVP; these impacts seem to infer that the expansion of the horticultural industry has been due to the introduction of PVP. Interviews with representatives of the horticultural industry however cited other drivers such as effective private sector entrepreneurs, favourable climatic conditions, relatively good infrastructure, and wide base of local labour and supportive policy environment. Interestingly, none of them referred to intellectual property.[320]

Biotechnology applications and grants in India

The First Schedule of The Patent Rules, 2003 stipulates what amounts are payable with respect to various aspects of a patent application. It distinguishes between natural persons and persons other than natural persons; interestingly, the Schedule does not make a similar distinction between Indian residents and non-residents as is the practice in most jurisdictions.

A survey of biotechnology patents between 1972 and 1988 and again in 1991 showed that patenting in biotechnology was mainly foreign dominated. In agriculture, most inventions related to plant growth regulators, veterinary vaccines, plant cells and tissue culture.[321] More recently, there has been a shift towards modern form of biotechnology such as genetic modification.

Figure 5.2: Biotechnology patent applications filed in India (1995-2002)



Source: TIFAC (2005)

[320] From five interviews with representatives from prominent foreign and local horticultural companies and from KEPHIS (2005)

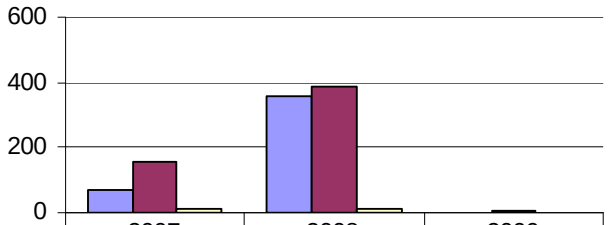
[321] Lalitha, N., Diffusion of agricultural biotechnology and intellectual property rights: emerging issues in India, *Ecological Economics* 49 (2004) 187

The Technology Information Forecasting and Assessment Council (TIFAC), the National Research Development Corporation and the various patent offices are charged with the responsibility of managing patent data. None of these use the International Patent Classification. Thus, while there is data available on the overall number of patent applications and grants, it is difficult to establish which of those relate to biotechnology generally and agricultural biotechnology specifically. This notwithstanding, figures from TIFAC estimate that there were about 2300 biotech patent applications filed in India by 2002.[322]

PVP applications in India

The Second Schedule of the Protection of Plant Varieties and Farmers' Rights Rules 2003 outlines the fees payable in respect of plant variety protection. It distinguishes between amounts payable by individuals, for educational and for commercial purposes. These are however not defined. There is no distinction between the amounts payable by small, medium and large commercial enterprises.

Figure 5.3: Plant variety applications in India May 2007 – February 2009



	2007	2008	2009
new varieties	69	355	2
extant varieties	154	387	5
farmers' varieties	12	12	0

Source: http://www.plantauthority.gov.in/download.htm

The PPV&FRA was implemented in May 2007. As of February 2009, 996 applications had been received none of which had been granted. 75% of the applications relate to extant varieties; over time, extant varieties will not command the highest share of applications once already existing extant varieties are protected; it is expected that new varieties will command the greatest share of the four categories in future. Only seven applications relating to farmers' varieties have been made. A number of initiatives have been launched with the aim of

[322] TIFAC employee, pers. comm. (2005)

consolidating information on varieties held by farmers and farming communities. Ramanna and Smale identify at least 8 such initiatives under government departments, independent foundations, NGOs and farmers' groups. These engage in a range of activities from registering grassroot innovations, documentation and registration of traditional knowledge and documentation of innovative practices of farmers.[323] These initiatives illustrate attempts by actors to make claims over varieties perhaps with the possibility of registering them under the Act. Whether they will follow through this ultimate action of registration is yet to be seen.

In her analysis of the impact of PBRs on the flow of resources, Ramanna argues that the new Act would dramatically alter the existing patterns of exchange of resources.[324] Analysing the patterns of exchange of PGRs between the public sector and the CGIAR, she proffers the possibility of the CGIAR centres charging for their material as a direct consequence of the public sector charging the CG Centres for the use of the public sector material protected under the Act. This, she argues, would result in a shift of the type of partners that the CG Centres would engage given the incentive to transfer material to actors who would pay for the PGRs rather than channeling the PGRs back into the public domain.

Ramanna fails to consider the possibility that PVP needn't be equated to an increase in the cost of PGRs. This is the crux of the argument in chapters three and four which distinguish between the existence and exercise of IPRs. Public institutes can register their varieties and still transfer them to the CG Centres and other actors on a license or royalty free. Chapter seven tests Ramanna's theory by examining the factors that influence choice of collaborating partners under ICRISAT–Private Sector hybrid parent seed consortia.

Subsection conclusion

National IP regime is only relevant to agricultural PPPs only at the stage where a decision is made to seek IP protection in the specific national jurisdiction. Once that point is crossed, the regime then dictates the criteria for the grant of rights, the scope and nature of the rights, the conditions for maintaining the right, etc. Arguably, before parties decide to apply for IP protection, national IP law is irrelevant to their research. Agricultural PPPs' research activities are governed by legislation other than IP: for example biosafety in the case of

[323] Ramanna & Smale (2004) *supra* note 65
[324] Ramanna (2003) *supra* note 66

agricultural biotechnology and seed and phytosanitary related legislation in the case of plant breeding.

5.5 Differing perspectives on IP

The previous section looked at the potential impact of IP legislation on agricultural research in Kenya and India; this section now addresses the impact of differing perspectives on IP on the conduct of agricultural research in the context of food security oriented PPPs.

In his analysis of the evolution of capacity for IP management in the International Rice Research Institute, Egelyng[325] develops a typology of IP and users which is summarized thus:

Table 5.7: Typology of IP and users

Type of users	Private	Public (national)	Public (international)
Examples	Private biotech companies	Universities, national agricultural research institutes	IARCs e.g. ICRISAT & ILRI
IP policy Objective	Appropriation; preserve status of all inventions as IP	Avail inventions into the public domain	Secure inventions for the international public domain
IP instruments used	Patents, trade secrets, plant patent (where jurisdiction permits), plant breeders' rights, copyright, trademarks, confidentiality agreements, material transfer agreements	Academic publishing (scientific criteria), material transfer agreements and copyright	Publishing (scientific criteria), defensive publishing, copyright, material transfer agreements, confidentiality agreements, employee contracts
Nature of in-house IP facility	IP clearinghouse, IP office/department or technology transfer office	None or basic, nascent IP administration unit mainly with one or two individuals	IP administration unit

Source: Egelyng (2005) with modifications

5.5.1 IP as perceived by the private sector

The private sector perceives IP in the economic rationale sense, i.e. a mechanism for recouping costs of invention and rewarding inventive efforts. Consequently, the main aim of IP protection is appropriation.[326] Lele et al argue that private sector investment in the

[325] Egelyng, H., Evolution of capacity for institutionalised management of intellectual property at International Agricultural Research Centres: a strategic case study, *AgBioForum* 8/1 (2005) 7

[326] Mugabe, J., Intellectual property protection and traditional knowledge: an exploration of international policy discourse, paper prepared for WIPO (1998) available at http://www.acts.or.ke/paper%20-

agricultural sector crucially depends on the protection of IP and that appropriation of benefits through trade secrets and IPRs remains a main deciding factor on private sector investment in agriculture.[327] Increasingly, companies' worth is calculated not in the traditional bricks and mortar but in intangible assets including intellectual property. A 'healthy' IP portfolio raises the market value of the company and thus affords it more leverage in dealings with other companies including its rivals.

The most common forms of IP protection in the private sector are patents, trade secrets, plant patent and plant breeders' rights, copyright, trademarks, confidentiality agreements and material transfer agreements. A review of the negotiations and debates leading to the development of the international patent regime and national patent and plant variety protection reveals the private sector, in developed countries particularly the USA, and its lobbyists as the primary advocates for adoption of legislation providing for stronger IP protection.

In terms of IP management and practice, the typical private company will carry out regular audits of not only its IP but other intangible assets with potential proprietary value. Egelyng identifies two traits characterising IP management in the private sector. Firstly, research reporting conforms to patent system requirements, i.e. measures that ensure strict record keeping and control of movement of materials and information. Secondly, mechanisms to guard secrecy and confidentiality are adopted. The IP office typically strips scientific publications of technical matter capable of patent protection. Confidentiality agreements typify dealings between technical departments and other companies such as manufacturers who need access to the scientific research in order to develop it into a final product.

5.5.2 IP as perceived by national public institutions and organisations

National public institutions are increasingly aware of IPRs although virtually all in developing countries lack adequate capacity in IP. Typically, their main IP policy objective is to put inventions into the public domain and traditionally this is by publication. Most of the representatives interviewed expressed their preference for publication over all other means of

%20intellectual%20property.htm who argues that IP is modeled on private gains and therefore more compatible with private sector research;

[327] Lele, U., Lesser, W. & Horstkotte-Wesseler, G., (eds.) *Intellectual property rights in agriculture, the World Bank's role in assisting borrower and member countries* (Washington DC: World Bank, 2000)

putting their research into the public domain. Most were of the view that this was the 'safest' way in the context of their overarching goal of providing public goods.

A few universities in both study countries have established IP offices or technology transfer offices although most are only a few years old and are still in the process of developing their IP policies. In the US, the oft-cited Bayh-Dole Act of 1980 is credited with stimulating the use of patent protection by universities for the research developed through federal funds.

In Kenya and India, enactment of similar legislation would be redundant as it presupposes that public universities and other public institutions are prohibited from seeking patent protection for their research. They are not; in any case, the TRIPs Agreement, adopted after the Bayh-Dole Act came into force, requires all member states to provide for the patent protection of all inventions regardless of the source of funding.

Although patenting is an option for IP protection of research from national public institutions, most choose not to seek IP protection. The four most common reasons are (i) lack of capacity to draft claims and carry out searches; (ii) lack of financial resources and time for IP administration; (iii) lack of financial resources to file applications and (iv) lack of understanding of and/or the complexity of the patent system.[328]

5.5.3 IP as perceived by public international organisations

Although these are more exposed to IP than national public institutions are, there is still scope for improvement of institutional capacity and understanding of IP. The underlying research objective is not dissimilar to that of national public institutions only in the case of public international organisations, the outlook is more global. The main IP policy objective is necessarily securing inventions for the international public domain.

In the past decade a few high profile cases[329] have exposed international agricultural research centres to IP controversies. These and other events catalysed the establishment of IP

[328] India & Kenya universities' representatives, pers. comm. (2005)

[329] For example the 'Enola' bean patent granted to a US seed company POD-NERS based on germplasm from the CG International Centre for Tropical Agriculture (CIAT); and Plant Breeder's Rights applications made in Australia by two Australian government agricultural agencies in relation to a peavine and a lentil which had

administration units in some CGIAR centres. At a system level, a Central Advisory Service on IP was created in 2000. Its mission is to serve the centres' 'needs regarding proprietary technology and facilitating expert advice and exchange of knowledge and experiences.'[330]

IP instruments include scientific publishing, defensive publishing, copyright, material transfer agreements, confidentiality agreements and employee contracts. In ICRISAST, the explicit IP policy is to use publishing as the primary means of availing research goods to the public domain.

> "ICRISAT considers that every effort should be made to ensure that research knowledge and products developed by the Institute are actively disseminated, adopted and utilised by and for the benefit of people in the developing world, and for society in general… [t]herefore, as its basic policy, ICRISAT pursues publication and full disclosure and the open sharing of ICRISAT data, information and knowledge through the release of ICRISAT research findings and products into the public domain."[331]

One of the main motivations for seeking IP protection in public international organisations is to prevent the appropriation of their research material by third parties especially the private sector. While this scenario is likely, it is equally probable that the 'appropriators' of the IARCs' material are the public itself: its national partners.

Wolson argues that although IP capacity and management in public organisations is needed mainly in order to prevent appropriation and infringement by third parties, it is just as important to ensure that the public institutions themselves do not infringe on the rights of third parties. Avoiding this would require capacity to negotiate Freedom To Operate (FTO) agreements among others.[332]

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been bred from genetic stock obtained from the CG International Centre for Agricultural Research in the Dry Areas (ICARDA).

[330] International Service for National Agricultural Research, Plan of work for a central advisory service on proprietary technology within the CGIAR 1999-2000 (The Hague: International Service for National Agricultural Research, 1998)

[331] ICRISAT policy on IP (2002) available at http://www.icrisat.org/ip_management/policy.htm

[332] Wolson, R., Intellectual property tools, innovation and commercialisation of R&D: Options to assist developing countries in positioning themselves to reap the benefits of a stronger intellectual property regime, with special reference to the role of intellectual property management in research organisations, paper presented

The differing perspectives on the concept of IP and IP protection invite different strategies for IP management. This provides fertile ground for conflict where partners from different sectors collaborate on research with potential proprietary value. This significantly influences how research is conducted in a PPP and how the PPP handles IP issues.

5.6 Conclusion

Save for providing the framework under which agricultural PPPs operate, international and national IP legislation *per se* have minimal impact on the execution of food security oriented agricultural PPPs. Among the FAO IT, the TRIPs Agreement and the UPOV Conventions, the FAO IT has the most impact on the conduct of research in agricultural PPPs involving the CG Centres. This is because it places the CG's ex-situ germplasm collection under the Multilateral System and provides for the terms of its transfer and that of other plant genetic resources by use of MTAs. The 1994 agreement between the FAO and the CG Centres further reinforces this as does the 'direct membership' that CG Centres have to the International Treaty.

National IP law *per se* has little influence on the conduct of research in agricultural PPPs save for the sections that require inventors to apply for patents in the host countries before they do so in other countries. In India, the fact that, as shown later, the ICRISAT-PS Hybrid Parent Seed Consortia have been operating in the absence of PVP law supports this argument. Biosafety and biotechnology legislation in ILRI's ECF project and seed law in the ICRISAT-PS consortia are more significant in the conduct of research in the two case studies.

The most important legal instruments in the conduct of agricultural research in the two case studies, as we will see in the next chapter, are the respective partnership agreements. This holds true for all agricultural research PPPs. Using the vertical-horizontal distinction, the partnership agreements in whatever form, make up the horizontal aspect. This is more important than the vertical aspect (international and national IP regimes). Building IP capacity is vital; parties must be competent in conducting IP related negotiations, drafting IP related agreements and contracts as these are the essential determinants of how IPRs are ultimately

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at 'The ICTSD/UNCTAD/TIPS Regional Dialogue on Intellectual Property Rights, Innovation and Sustainable Development in Eastern and Southern Africa' South Africa, 29 June - 1July (2004)

exercised and concomitantly, how a PPP's food security goals are met. The public and private sectors' perspectives on IP are influenced by the parties' IP policies and by the partnership contract and are more important to a PPP than domestic IP legislation *per se*.

Chapter Six

Contextualising the case studies: ILRI's ECF vaccine project & the ICRISAT-PS consortia

6.0 Introduction

One effect of privatisation of agricultural research is that International Agricultural Research Centres and other public research organisations are increasingly exposed to interaction with the private sector. In addition to this, the globalisation of the intellectual property regime among other factors is responsible for the rise in significance of IPRs in agricultural research to both public and private research organisations. The transition to a more demand led research agenda has increased the awareness in IARCs that commercialisation of products of research may be key to their sustainable delivery to users and that the private sector is an integral part of this delivery.

Some public research institutes have formulated policies on IP and on partnership with the private sector in response to this inevitable exposure. For IARCs in the CGIAR such as ILRI and ICRISAT, these policies are influenced by their membership of the CGIAR system. This chapter has two main aims: firstly, to locate the case studies within (i) agricultural PPPs generally; (ii) PPPs in the CG Centres and (iii) PPPs in ILRI and ICRISAT. In so doing, it tests the typicality of the case studies and attempts to draw implications on how they are influenced by their specific contexts. Secondly, this chapter similarly locates ILRI's and ICRISAT's IP policies within the general CG system wide policies. Chapters three and four underscored the need to have creative policies that facilitate mitigating the excludability effect of IPRs particularly in food security and other social welfare oriented institutions. This chapter analyses the ILRI's and ICRISAT's IP policies within this context and attempts to draw implications relating to the formation of partnerships in the respective Centres.

The first section comprises an in depth review of the ECF project at ILRI and the ICRISAT-Private Sector hybrid seed consortia. It covers the background of the respective PPPs, the rationale, their organisation and design, the partners involved and their roles, the activities,

achievements and impacts to date. Virtually all the information for this section is based on the interviews conducted during fieldwork; data collection ended in December 2006 and the partnerships may have evolved since. The next section locates the case studies in agricultural PPPs, PPPs in the CG and PPPs in the respective Centres by using various indicators identified in previous studies and in existing literature.

The third section of the chapter analyses ILRI's and ICRISAT's respective IP policies. It looks at how the CG system wide IP policies have influenced the respective Centres' policies. It also investigates whether (i) the policies are creative enough to mitigate the excludability effect of IPRs and (ii) the policies aid or inhibit collaboration with the private sector.

6.1 A brief profile: ILRI & ICRISAT

Being part of the CG system, the two Centres conduct research primarily addressing food security. The CGIAR's mission is to 'contribute to *food security* and poverty eradication in developing countries through research, partnership, capacity building and policy support.' All projects conducted in the CG Centres have food security oriented goals.

ILRI was established in 1994 when the International Livestock Centre for Africa based in Addis Ababa, Ethiopia and the International Laboratory for Research on Animal Disease based in Nairobi, Kenya merged. While ILRI's headquarters are in Nairobi, ILRI maintains a second principal campus in Addis Ababa. ILRI's research activities are organised around four themes: targeting and innovation, market opportunities, biotechnology and people livestock and the environment.

ILRI has over 700 staff from about 40 countries. About 11% of the staff are internationally recruited and represent over 30 disciplines. The rest of the staff is made up of Kenyan and Ethiopian nationals. ILRI is governed by a board of trustees made up of twelve professionals with experience in development and management issues.

ILRI receives its funding from over 60 sources comprising private, public and government organisations in both developed and developing countries. Some donors support ILRI with core and programme funds whereas others finance individual research projects. In addition to this financial support, host countries i.e. Kenya and Ethiopia provide in-kind support.

ICRISAT is one of the oldest institutions in the CGIAR having been established before the CGIAR. ICRISAT has six offices in Africa; its headquarters are in Hyderabad, India. Like ILRI, ICRISAT's activities are organised around four global themes. These are markets, policy and impacts; harnessing biotechnology for the poor; crop improvement, management and utilisation for food security and health; and agro ecosystems. ICRISAT's mandate crops are pearl millet, sorghum, chick pea, pigeon pea and groundnut.

ICRISAT has over 900 staff who make up about 14% of total CGIAR staff and is one of the largest CG Centres. Of these, only 6% are internationally recruited. In 2005, ICRISAT's total funding amounted to US$28.4m; about 80% of this was received from CGIAR members in Europe, North America and international and regional organisations. The rest was from other CGIAR members and non members the latter of who contributed US$2.5million.

Table 6.1: Share of Centres' total expenditure, policy & partnerships, 2003-2005 (%)

	2003		2004		2005	
	ILRI	ICRISAT	ILRI	ICRISAT	ILRI	ICRISAT
Policy	6	11	6	13	10	37
Collaboration & partnerships	6	6	12	6	29	12

Source: www.cgiar.org

For ILRI, the share of expenditure on collaboration and partnerships doubled between 2003 and 2004 showing increased prioritisation of collaboration; this however does not correlate with the share in policy development. One may infer that the policies existing in ILRI between 2003 and 2004 were sufficient to support the type of partnerships that the institution engaged in during the same period and that the type of partnerships engaged in were relatively of a similar nature and thus did not require the need to invest in further development of policy. The share spent by ICRISAT in development of policy more than tripled between 2004 and 2005 showing a high prioritisation of policy. This correlates with an increase in the share of expenditure on collaboration and partnerships which doubled in the same period. This correlation is supported by 2003/2004 data where investment in both policy development and in collaborations did not change.

6.2 ILRI ECF Vaccine Project

6.2.1 Background

The ECF vaccine project is an animal health product development partnership. East Coast Fever (ECF) is a tick-borne disease affecting cattle in eastern, central and southern Africa; it is caused by a parasite known as *Theileria parva* (*T. parva)*. The *Theileria* livestock parasites cost the world US$1 billion annually.[1] *T. parva* is one of the most serious of the *theilerial* livestock diseases and is responsible for over one million cattle deaths annually; 25 million cattle across 11 countries of eastern, central and southern Africa are at risk.

The impact of ECF is profound on the livelihoods of small holder farmers in this region. ECF causes high morbidity and mortality in cattle and prevents the introduction of improved breeds of cattle which, while highly productive, are particularly susceptible to tick-borne diseases. It is estimated that in Africa, a cow succumbs to ECF every 30 seconds.[2] For small holder farmers, who are the backbone of East Africa's rural economy, ECF has grave economic consequences. Most of these farmers rely on their cattle; their death directly undermines the farmers' livelihoods as it represents a loss of income with direct consequences on their ability to feed, cloth and educate their families.[3] ECF therefore increases the vulnerability of small holder farmers who are already on the brink of poverty. So important is ECF that the governments in Kenya, Uganda and Tanzania rank ECF in the top two priorities for animal research.[4]

6.2.2 Project's objectives

The purpose of the ECF project is to develop methods for the integrated control of ECF, combining improved vaccine, diagnostics and decision support systems. The short term scientific objective is to 'develop an experimental multi-component subunit vaccine against ECF that is shown to be protective to cattle in laboratory trials' while the long term scientific objective is to 'generate a safe, highly efficacious, affordable and easily deliverable ECF

[1] ILRI, 'Lords of life and livelihood' available at www.ilri.org
[2] DfID, 'Towards a pro-poor vaccine for East Coast Fever, Project R8042' available at http://www.dfid-ahp.org.uk/index.php?section=3&subsection=25
[3] ILRI, 'When speed matters' available at http://www.ilri.org/ilripubaware/uploaded%20files/20048111010340.03BR_ISS_WhenSpeedMatters(ECF).htm
[4] DfID, 'Integrated control of East Coast Fever in cattle of small-holder farmers' available at http://www.dfid-ahp.org.uk/index.php?section=4&subsection=48

vaccine.'[5] Although achievement of food security is not mentioned in the project objective, the implications of the project on this are clear. The final beneficiaries of the project are resource poor small holder farmers in the East African Region who rely on their cattle for their livelihood including providing income to feed their families. ILRI's mission is to 'work at the crossroads of livestock and poverty, bringing high-quality science and capacity-building to bear on poverty reduction and sustainable development for poor livestock keepers and their communities'. Its strategy is premised on the belief that livestock have a positive effect on diets, health, incomes, financial security, sustainable crops yields, employment prospects and social status. Moreover, as a CG Centre, ILRI's mission is inextricably linked to improving food security. The CG's mission is to 'contribute to food security and poverty eradication in developing countries through research, partnership, capacity building and policy support.'

6.2.3 Treatment of ECF

ECF is currently treated by use of a strategy known as infection-and-treatment method (ITM) which involves inoculating live *T. parva* parasites into an animal and simultaneously treating the animal with an antibiotic. Although this method is very effective in immunising cattle, it is considered inconvenient and costly. It requires trained personnel to administer the live vaccine and monitor any reactions and secondly, the live *T. parva* parasites need to be maintained in liquid nitrogen 'cold chain' which adds to the cost and logistical complexity. Because of this, ITM is deemed to be complicated and unsuitable for pastoral production systems.

Control of ECF by use of tick killing sprays is expensive and its continued use can lead to tick resistance to the acaricides. The spray can also leave toxic residues in milk and meat that render the products unsafe for humans. Needless to say, it is environmental unfriendly. The prevailing situation makes the case for research into simpler, safer and more accessible treatment of ECF.

It was on this basis that the ECF project was conceived. The project is an ongoing, unique product development partnership made up of eight partners who have both distinct and

[5] ILRI, pers. comm.

overlapping roles. The partners bring different areas of expertise and resources into the partnership. These can be represented thus:

Table 6.2: The parties in the ECF project and their roles

Partner & location	Sector	Main role
ILRI, Kenya	IARC	Coordinating research; identifying genes and assignment of gene functions (gene annotation) identifying potential vaccine candidates;
The Institute for Genomic Research (TIGR) which has since merged with other institutes to form the J. Craig Venter Institute, USA (TIGR is used in this thesis)	Private not-for-profit	Sequencing genome of *T. parva*; gene annotation
The University of Victoria, Canada	Public	Interpreting sequence data
The Oxford University, UK	Public	Provide technologies for vaccine delivery
The Ludwig Institute of Cancer Research (LICR), Belgium	Public	Develop efficient screens of parasite proteins
Merial Ltd, France	Private	Provide technologies for vaccine delivery; product development – manufacturing, licensing and marketing
NARIs e.g. KARI and the Department of Veterinary Services (DVS) both in Kenya	NARI	Testing; clinical/field trials
DfID, UK	Public	Funded research

The idea of developing an alternative treatment to ECF through partnership was conceived in the late 1990s by an ILRI scientist and a researcher from The Institute of Genomic Research (TIGR), a not-for-profit private company based in Maryland, USA. The then Director General of ILRI allocated US$300,000 from ILRI's core funds to fund TIGR's genome sequencing of *T. parva.* TIGR injected US$1.6 million, US$100,000 of which was from the chairman's personal funds.[6] The UK Department for International Development (DfID) subsequently granted US$5million over a three year period. Additional contributions came from Rockefeller Foundation and the U.S. Agency for International Development.

[6] ILRI, 'The power of public-private partnerships' available at http://www.ilri.org/ilripubaware/uploaded%20files/2004891038450.03BR_ISS_PowerOfPublic-PrivatePartnerships.pdf

Table 6.3: The ECF project contractual engagements timeline

late 1990s	Partnership conceived by ILRI scientist and TIGR researcher
Late 1990s	Seed funding provided out of ILRI's core funds and from TIGR
Oct 1998	Merial and ILRI discuss the possibility of undertaking joint research and sign a confidentiality agreement
May 1999	research agreement between ILRI & TIGR on sequencing, analysing and annotating, facilitating web-based access and preliminary functional analysis
Feb 2001	Funding proposal submitted to University of Edinburgh & DfID
June 2001	Agreement signed with LICR
June 2001	Agreement signed with University of Victoria
July 2001	A sub contract with University of Edinburgh
Oct 2001	Agreement signed with University of Oxford
Nov 2001	Merial joins partnership through Letter of Intent

Funding from DfID was via a sub-contract from the University of Edinburgh, the grant holder, which subsequently sub contracted the consortium to carry out the research. The purpose of this arrangement is unclear. To add to the complexity, the funding agreement required the partnership to grant DfID through the University of Edinburgh, a non-exclusive licence of the end product; DfID is to retain the sublicence and can grant it to any party (even those outside the partnership) to supply the end product.[7] This seems consistent with mechanisms commonly employed in product development partnerships as discussed in chapter four. The main aim is to ensure the delivery of end products by reserving the right to grant licenses to third parties as a safety provision in case the stipulated commercial partner does not honour the terms relating to delivery.

By 2006, funding from DfID had expired and therefore technically. DfID was no longer part of the partnership. The clause granting DfID the non-exclusive license to the end product was not amended. The effect of this is potentially grave: firstly, it is unusual that a former consortium member can dictate the terms of the consortium after the member's departure. It amounts to a party outside a contract influencing the terms of the contract. This goes against the basic tenets of contract law. Secondly, concerns were expressed over the effect of DfID's 'remote control' of the IP on potential collaborators.[8]

This could have been resolved by a simple amendment of the agreement or a clause stipulating that on exit of a partner from a consortium, its contribution to research would be negotiated by the parties. The fact that this was not flagged out by ILRI as the coordinator of

[7] ILRI, pers. comm.
[8] ILRI, pers. comm.

the project underscores the need for increased institutional capacity in IP as advocated for in chapter four.

6.2.4 Project structure

Initially, the staggered membership and chronological progress resulted in ILRI signing different agreements with each partner. It was recommended that all agreements be put under one master agreement which would provide for the rights, duties and obligations of all parties. The agreement is not static and has in built provisions allowing for its evolvement. The project is in two phases. Phase I is the proof-of-concept and is largely laboratory based. This phase involves the identification of vaccine candidates and their evaluation in cattle. ILRI is the lead coordinator in the proof-of-concept phase. The second phase comprises product development and commercialisation which involves field testing for safety and efficacy, licensing and distribution. Merial and the NARIs take the lead in phase II.

Table 6.4: ECF project progress

Basic research	Discovery	Proof-of-concept: Vaccine formulation & testing	Product development trials & scaling-up production	Product launch
• Bovine immunology • Parasite biology	• ECF parasite genome sequencing • Identification of suitable candidate antigens	• Demonstration of induction of responses associated with significant protection against vaccine	• Product development trials: • Dose • Safety • Duration of protection • Efficacy against different parasite strains • Registration and licensing • Scaling up production	• On going production • Marketing • Distribution and sales • Product support
• ILRI	• TIGR • LICR • ILRI • Univ. of Victoria	• ILRI • Merial • Univ. of Oxford	• Merial • NARIs	• Merial

Year 0 → Year ???

Source: ILRI, with modifications

Stage of project as at Dec 2006

6.2.5 Motivation for joining the partnership

The incentives for joining the partnership vary across the membership. Overall, from a scientific point of view, research in *theileria* parasites provides vital insights into human diseases. The *T. parva* has an unusual biology; *theileria* parasites are the only parasites known to transform healthy cells into a cancer-like state causing uncontrolled proliferation of white blood cells. 'This means that the parasite is manipulating the biochemical pathways that cells use to regulate their growth and suggests that scientists may be able to use *T. parva* to gain deeper insight into human cancers.'[9]

In addition, the *T. parva* parasite is closely related to the organisms that cause human malaria, HIV/Aids and TB. The impact of these diseases especially in Africa cannot be overstated. The immune response engendered by the ECF vaccine candidates 'are precisely the immune responses researchers working to develop vaccines for HIV/Aids, TB, malaria and cancer are striving to achieve.'[10] Of direct commercial incentive to the private sector, other members of the *T. parva* family infect sheep, goats and deer and put 200 million cattle at risk across the Mediterranean Basin and Asia.[11]

The potential for the science in the project to assist in building a clearer understanding of how vaccines of greater commercial interest may be developed was one of the main incentives for Merial to join the partnership.[12] Merial had little to loose; the funds for the project were from DfID. The project 'subsidised' Merial's research and provided it with an opportunity to test its vaccine delivery system. According to ILRI, the identification of partners to invite to the partnership was informed by ILRI's perception of the skills and expertise required to move from the science to the end product and the partners most suited to provide the skills and expertise; comparative advantage and competency were therefore high in the list of criteria used in identifying potential partners.[13]

[9] ILRI, 'The power of public-private partnerships' *supra* note 6
[10] DfID, 'East Coast Fever Vaccine: towards a pro poor vaccine for East Coast Fever: R8042' *supra* note 2
[11] ILRI, 'Lords of life and livelihood' *supra* note 1
[12] Merial, pers. comm.
[13] ILRI, pers. comm.

TIGR had great expertise in gene sequencing; TIGR sequenced the first complete genome of a living organism in 1995 and went on to sequence the human genome in 2001.[14] Merial is a world leader in development, manufacture and distribution of animal vaccines; ILRI considered its involvement vital. Merial already had proprietary delivery technology which it brought into the partnership. A team from the University of Oxford also had expertise in proprietary technology for antigen delivery systems. KARI provides a wealth of knowledge of field sites for testing of experimental vaccines; working with local partners of which NARIs are the most significant, is part of ILRI's mandate. ILRI saw itself as best suited to coordinate the research; it benefits from years of research in animal diseases affecting the poor, has expertise in bovine immunology and excellent large animal containment facilities.

6.2.6 Achievements and impacts

The project was at the proof-of-concept phase as at December 2006. Some of the major milestones are:

- The *T. parva* genome was sequenced and published.[15]
- Identification of eight vaccine candidate antigens was completed. These were evaluated and shown to be successful. The results were published.[16]
- The vaccine candidates were combined with effective antigen delivery systems. A promising delivery system was identified; this is based on an adaptation of proprietary technology supplied by Merial
- The team demonstrated that all the cattle that survived after being vaccinated with the candidate antigens using the delivery system and then exposed to a dose of parasites that would usually kill the cattle, generated the desired type of immune response

As the project is still ongoing, one can only refer to the potential impact of the ECF vaccine. The expected cheap, effective, safe and convenient method to deliver vaccine could prevent one million cattle deaths and could save an estimated US$300million per annum. The ECF vaccine is expected to cost farmers about 20% of the current 'live' ITM vaccine thereby making it more accessible to small holder farmers.

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[14] TIGR, 'Partners on the digital frontier' available at www.ilri.org

[15] Gardner, M., *et al.*, Genome sequence of *Theileria parva*, a bovine pathogen that transforms lymphocytes, *Science* 309 (2005) 134

[16] Graham, S., *et al.*, *Theileria parva* candidate vaccine antigens recognised by immune bovine cytotoxic T lymphocytes, *PNAS* 103/9 (2006) 3286

Other potential impacts stem from the scientific breakthrough of the project. The science is expected to provide valuable insights into other animal and human diseases caused by close relatives of *T. parva*.

A significant impact of the project to date is its contribution to capacity building. Firstly, African scientists and technicians have benefited from training through the project; this has had direct consequences on the capacity of animal health research in developing countries. Secondly, ILRI's involvement at the genome sequencing and annotation stage underpinned the establishment of the first bioinformatics unit in eastern and central Africa; this is situated at ILRI. In 2003, the New Partnership for Africa's Development (NEPAD) endorsed the establishment of the Biosciences for eastern and central Africa (BecA), a network of research facilities from participating institutions whose aim is to facilitate and support state-of-the-art research in biosciences to produce technologies that help the poor. ILRI was chosen to host the central hub which will provide a common biosciences research platform for the region. The bioinformatics unit at ILRI, established under the ECF project, forms the centrepiece of the services offered by BecA.[17]

Thirdly, and perhaps the most profound impact of the project, is that on organisational and institutional culture. The creative collaboration pursues new ways of conducting research and producing results from the research. It challenges the conventional methods of institutional research and development. In the past, virtually all research by the public sector was technology led; the most common effect of this model of research was good science accompanied by a failure to deliver effective and affordable products downstream. The ECF model of partnership adopts a demand led research approach for the benefit of poor farmers.

Smith writes of the project from an innovations systems perspective describing it as

> 'a potentially new model of institutionally disembedded research and development partnership that functions in a developing country context... [it] provides an example of a more 'complete' approach to innovation, understanding the need to both identify needs and priorities...'[18]

[17] ILRI, 'Genomics breakthrough made by Kenya and USA institutes on cattle-killing parasite' available at www.ilri.org

[18] Smith, J., Context-bound knowledge production, capacity building and new product networks, *J. Int. Dev.* 17 (2005) 647

For ILRI, the resounding effect of the project was that it instilled into the scientists involved new ways of thinking and of learning.[19] Smith continues that 'the network has forced older institutionally-embedded technical knowledge bases to be re-oriented outwards, and has generated new knowledge bases and capacity that is institutionally dis-embedded and tacit.'[20]

6.2.7 Lessons learnt

ILRI had no experience with PPPs at the scale of the ECF project. Scientists interviewed referred to the project as being a 'steep learning curve'. Although the project is a great leap forward in terms of organisational and institutional practice, with it comes the challenges of managing such a partnership. ILRI has had to learn how to balance the interests of the partners, manage the expectations of the parties, deal with differing institutional cultures and trust issues although these were more perceived rather than real.[21] Issues related to intellectual property, agreements between the parties and staggered membership have also proved to be a challenge. These issues are examined in depth in the next chapter.

Key lessons include keeping the overarching goal of providing a pro-poor ECF vaccine in mind at all times, clear communication with parties throughout the process, having clear and concise agreements in place which anticipate future engagements, amending agreements as soon as the need occurs and addressing conflicting and disconnected policies and practices.[22]

6.3 The ICRISAT-PS consortia

In the 1970s when ICRISAT was established, public agricultural research was underpinned by the institutional dualism prevalent at the time which made a strict distinction between private and public sector research. The former was seen as primarily driven by a profit motive and would therefore invest in areas with margins of return while the latter had no business investing in areas that the private sector could invest in. This rigid notion of public goods informed a variety of beliefs which in the case of ICRISAT included firstly, that ICRISAT's research would exclusively be for the benefit of the public sector which included farmers and other public institutions; and secondly, that the Indian Council of Agricultural Research,

[19] ILRI scientists, pers. comm.
[20] Smith (2005) *supra* note 18
[21] ILRI, pers. comm.
[22] ILRI, pers. comm.

India's national research organisation, would be ICRISAT's main partner and main recipient of ICRISAT's research products.[23] These assumptions and beliefs are reflected in ICRISAT's policy of the time.

Events catalysing the formation of the ICRISAT–PS consortia can perhaps be traced back to India's liberalisation policies in the late 1980s. The Seed Policy of 1988 allowed for the growth of the private seed industry; under the Central Seed Act of 1966, supply of seed for most staples in India was dominated by the public sector. Currently, private seed companies dominate seed production and supply in India.

Three major factors can be arguably credited with the genesis of collaboration between ICRISAT and the private sector which eventually led to the consortia. Firstly, as the private sector grew, it developed significant research capacity which meant that it could conduct research competitively and was no longer a passive recipient of ICRISAT bred material. Secondly, the CGIAR Centres were experiencing funding shortages; there was increased pressure to demonstrate the impact of international agricultural research; as a direct consequence of the funding crunch, ICRISAT needed to find alternative means to supplement its research budget. Thirdly, being market driven, the private sector provided what the consumers (seed merchants and farmers) wanted. What the end users wanted was not necessarily what ICRISAT provided. For example, in the case of pearl millet and sorghum, two of ICRISAT's mandate crops, ICRISAT's breeding strategy was breeding for resistance to biotic and abiotic stresses such as resistance to grain mould.[24] ICRISAT's focus was on improvement of 'small hard grained types' of sorghum hybrids. The private sector on the other hand, having direct contact with seed merchants and farmers, discerned the demand for not ICRISAT-type 'small hard grained types' but 'large grained types' with high grain and fodder yields. The private sector sought to develop the hybrids that farmers wanted.

ICRISAT's view of the private sector can be said to have changed in at least four aspects. Firstly, the private sector was seen as a research partner in its own right and secondly, being

[23] Reddy, B., Hall, A. & Rai, K., 'The long road to partnership: private support of public research on sorghum and pearl millet' in Hall, A., Yoganand, B., Sulaiman, R. & Clark, N., (eds.) *Sharing perspectives on public-private sector interaction: proceedings of a workshop, 10 April 2001, ICRISAT, Patancheru, India* (New Delhi and Patancheru: National Centre for Agricultural Economics & ICRISAT, 2001)

[24] Sorghum is often damaged by late monsoon rains and therefore suffers grain mould

close to the end users, the private sector was an invaluable source of feed-back information. This was vital given the pressures on impact of research resounding in IARCs at the time.

Table 6.5: Chronology of events leading to the development of the ICRISAT-PS consortia

Early to mid 1990s	ICRISAT's breeding strategy priorities changed from yields enhancement to resistance to biotic and abiotic stresses with a view to improving production sustainability in Africa
Mid 1990s	The private sector became aware that new breeding material from ICRISAT did not include characteristics preferred in the Indian market for sorghum and millet hybrids
Mid 1998	ICRISAT scientists made initial contacts with seed companies with a view to developing a project that would produce outputs directly related to seed companies
October 1998	Decline in unrestricted core funding necessitated seeking funds from alternative sources. The need to mobilise funds from the private sector was emphasised at the International Centres' Week.
Early 1999	ICRISAT scientists continued discussion with the private sector on the possibilities of providing financial support for ICRISAT's research portfolio on diversifying sorghum and millet hybrids.
Early 1999	The proposals for consortia for sorghum and millet were developed and submitted to the
Mid 1999	Further discussions between the private sector and ICRISAT scientists
September 1999	ICRISAT Governing Board approved the proposed partnerships with the private sector in principle
End October 1999	ICRISAT Donor Relations Office received the consortia proposals from the Genetic Resources and Enhancement Programme's programme director
End October 1999	Budget estimates for the consortia proposals were cleared and approved by ICRISAT's finance division
Early November 1999	The proposals for sorghum and pearl millet were modified to make them uniform in terms of structure, budget, and terms and conditions. Revised versions were sent to Donor Relations Office
November 1999	The proposals were sent to ICRISAT's Interim Director General's office
November 1999	ICRISAT's Interim Director General advised against pursuing the private sector for small grants. Detailed explanation by scientists and their intention to seek funds from the private sector were made to Donor Relations Office
December 1999	The proposals were sent to the Officer-in-Charge for the Director General who advised that they should be sent to the new Director General who would take charge in January 2000
End January 2000	Donor Relations submitted proposals to the new Director General who advised that an assessment be made of the implications of the proposed partnerships. Discussions between the Director of ICRISAT's Genetic Resources and Enhancement Programme and the new Director General resolved pending issues
Late January 2000	The proposals were approved by the Director General and dispatched to private seed companies

Source: Reddy et al. (2001) with modifications

Thirdly, ICRISAT saw the private sector as a valuable conduit for delivery of its research products. This represented a major shift from the informal networks that ICRISAT had hitherto used to get their products out into the market. Fourthly, ICRISAT recognised the potential for obtaining funding from the private sector. The private sector was therefore seen as a valuable research partner and a source of funding. This shift might have been strengthened by the prioritisation of partnerships and collaborations in ICRISAT (table 6.1).

A series of meetings between ICRISAT and the private sector were held. ICRISAT facilitated the private sector's participation in conferences, field days and study tours. It was during one such meeting that the then president of the All India Seed Association suggested funding through a consortium of seed companies. The initial proposal related to research in sorghum and pearl millet hybrids. It took almost two years from the conceptual stages to the actual signing of the agreements between ICRISAT and the private seed companies.

6.3.1 Structure and details of the consortia

Since the signing of the agreements in January 2000, the proposals have been revised and expanded to increase the level of funding from the private sector and to include another consortium on pigeon pea. Membership to the three consortia has been steadily increasing since their respective launching.

After much debate on the models for partnership, the consortium model was recommended.[25] Other models under consideration were the licensing/royalty model, the turn-over based check model and a mixed model. The consortium model was preferable to the other models on many grounds: firstly, 'free riding' was cause for concern to the private sector. A seed company on its own would be reluctant to sponsor ICRISAT research under the other models as any new material produced as a result of the partnership would be accessible to other non-investing company and the general public. The interest, participation and commitment of many seed companies was therefore vital to address the issue of free-riding; if all major competitors were members of the consortium, there would be fewer opportunities for free riders. The consortium model best provided the means to which this could be achieved.

Secondly, the consortium model was found to be financially the best option for ICRISAT and for the private sector partners. By imposing similar funding requirements from the seed companies, albeit in two tiers, the cost for funding research for the individual consortium members would be reduced. The funding support from the consortium members would be primarily based on their own assessment of its cost effectiveness.

[25] Recommendations of the Research Committee submitted to the Management Group (2003)

The main incentive for the private sector was that although ICRISAT supplies raw germplasm to all scientists in the public and private sectors on request, supply of value-added breeding lines would be made available to consortium members earlier than non-members who would have to wait for a minimum of three years before they got the improved breeding lines and value added parental lines either directly from ICRISAT or from national breeding programmes.

The Research Committee lists five advantages of the consortium model:

(a) The grants are provided for ICRISAT's agreed research agenda and can be used for other ICRISAT research according to ICRISAT's evolving research needs
(b) As the funds are in the form of research grants, they are not received with respect to any particular materials supplied to the private sector. The effect of this is that any returns or output from the funds is not exclusive to the private sector; it remains in the public domain
(c) Consortia members select materials at various stages of development and fine-tune some of these to meet their needs
(d) There is no restriction on the number of lines that the consortium members can select. This leads to liberal selection and seed supply which in turn contributes to enhanced diversity of their programmes and to on-farm diversity
(e) The consortium model generates a feeling of ownership which contributes to more congenial interaction between ICRISAT and the private sector[26]

Under the three consortia, each seed company joins the respective consortium by entering into an agreement with ICRISAT to provide a research grant under the technical and administrative terms and conditions. Seed companies belonging to more than one consortium have to sign an agreement in respect of each consortium. Companies in a consortium do not enter into any formal agreement with each other; this leaves membership open-ended allowing other seed companies to join each consortium without the involvement of other members. This makes entry into the consortium relatively easy. The Letters of Agreement are in standard form; members belonging to either tier (discussed below) sign a similar agreement *mutatis mutandis* to the crop.

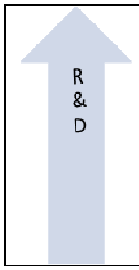
[26] Id

6.3.2 Terms of the agreement

Firstly, consortia members are divided into two categories: primary and promotional. The primary members are large and medium sized companies with well established research, development and marketing infrastructure which market more than 1000 tonnes of hybrid seed annually, while the promotional members are small and/or start up companies marketing less than 1000 tonnes of hybrid seed annually. These are encouraged to join as primary members although they are also offered promotional membership. Should they join as promotional members, they are expected to 'graduate' to primary membership in two years.

For each of the three consortia, grant contributions from the primary members is US$10,000 per annum while that from the promotional members is US$5,000 for each consortium. Indian-based companies are allowed to pay the grant contribution in Indian Rupees to avoid the $/Rs fluctuation. The type of membership dictates the level and priority of access to ICRISAT material. The material for the three consortia falls into four categories: (i) breeding lines; (ii) A/B under conversion; (iii) near finished A/B/R lines and (iv) parents of released/ commercial A/B/R lines. The four categories are supplied to the seed companies based on their membership and on charge basis; consortium members receive a 50% discount.

Table 6.6: The level and priority of access to ICRISAT material



	Category of improved breeding materials	Level and priority of access			Charge/ sample (US$)[1]
		Primary members	Promotional members	Non members	
4	Released/commercial A/B/R lines[2]	Yes	Yes*	Yes*	400
3	Finished A/B/R lines[3]	Yes	Yes*	No	350
2	A/B pairs under conversion	Yes	No	No	200
1	Breeding lines (F_4/S_2 onwards)	Yes	No	No	100

Source: Guidelines for ICRISAT–Private sector partnership in hybrid parents research consortia (2003), with modification

[1]A sample refers to 5 grams of seed per sample of sorghum and pearl millet and 10 grams of seed per sample for pigeon pea

[2]refers to lines identified as parents of hybrids tested or released by national programmes, or parents of hybrids developed and commercialised by seed companies or registered as potential hybrid parents at ICRISAT

[3]refers to well characterised lines (according to ICRISAT nomenclature) as promising hybrid parents

**see discussion below*

6.3.3 Conditions for access

Category 1 material is the basic 'building blocks' of commercial lines. The R&D effort increases from category 1 to category 4 of the materials. Primary members have access to all four categories while promotional members have access to the last two. The breeding lines (category 1) and category 2 material are available only to primary members. Promotional members gain access to category 3 and 4 materials three years after they are named at ICRISAT. Non- consortium members do not have access to category 1 to 3 of the materials but have access to the last category of materials three years after they are supplied to consortium members. These levels and conditions for access are discussed in chapter seven.

The breeding materials are to be supplied on specific request from the consortium or non consortium member. Transfer of breeding material from ICRISAT is via an MTA which stipulates that the material supplied to the public or private recipient is for their use only and cannot be transferred to a third party. The standard Letter of Agreement stipulates that ICRISAT 'will retain the exclusive right of registration of materials and publication of research information pertaining to international public goods' although funding support from the seed company will be acknowledged. It categorically states that the seed company will not have any exclusive rights to use the products of ICRISAT's research and that use of ICRISAT's name directly in the course of marketing the company's product is prohibited. There is no mention of a requirement to acknowledge the material was obtained from ICRISAT.

Progress is to be monitored annually by highlighting major research findings with details of breeding products developed during that year. ICRISAT undertakes to provide training to technical staff of the seed company at the latter's cost; ICRISAT also undertakes to invite the company for meetings, seminars and field days relevant to the consortium commodity.

The standard Letter of Agreement establishes an Advisory Committee consisting of three private sector members and two members from ICRISAT whose mandate is to monitor and provide guidance to the consortia. The Committee meets twice a year to resolve any issues and review the arrangements. ICRISAT's Management Group is authorised to review the contributions and charges from time to time in consultation with the Advisory Committee.

Dispute settlement is firstly managed through mutual discussion between the parties failing which, a determination by ICRISAT's management is final and binding. The standard Letter of Agreement does not contain an exit clause; the presumption is that non payment of the annual grant renders membership as cancelled. This however does not address those promotional members who fail to advance to primary members after two years and what they are entitled to. Fortunately, such scenarios have not presented themselves to date.

Table 6.7: Consortia membership as at September 2005

	Primary members	Promotional members	Total
Sorghum consortium	12	6	18
Pearl millet consortium	17	8	25
Pigeon pea consortium	6	4	10

6.3.4 Impact of the consortia

In 2004, about 80% of the total rainy season sorghum and one million hectares of the summer season sorghum were planted with about 50 private sector based hybrids; 30 of these were based on ICRISAT derived parental lines. Similarly, 60% of the total area under pearl millet cultivation is from over 70 private sector based hybrids 60 of which can be traced back to ICRISAT through the pearl millet consortium. Gowda reports that these hybrids have made substantial contributions in enhancing genetic diversity, productivity, yield stability and improved the livelihoods of poor farmers in arid areas.[27]

In terms of resource mobilisation, the three consortia generated more than US$400,000 in the first three year period. From 2004, the consortia are expected to generate US$2 million over a five year period.[28]

The most profound impact of the consortia is on ICRISAT's organisational culture.[29] The evolving relationship between ICRISAT and the private sector is increasingly being credited with opening the way for a variety of relationships with partners.[30] This represents a major organisational and operational shift from one that is highly bureaucratic and hierarchical to

[27] Gowda, C., Reddy, B. & Rai, K., ICRISAT strengthens ties with private seed companies, *Asian seed and planting material* 10/4 (2003) 16
[28] ICRISAT, pers. comm.
[29] Hall, A., Sulaiman, R., Clark, N. & Yoganand, B., From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research, *Agricultural Systems* 78 (2003) 213
[30] Reddy *et al.* (2001) *supra* note 23

one that is dynamic and flexible. This organisational change is demonstrated by ICRISAT's initiatives under the Agri-Science Park (ASP), the platform over which all partnership related work at ICRISAT is conducted. Besides the three consortia discussed above, the ASP also covers the Ag-biotech Innovation Centre (AIC), the Agri-Business Incubator (ABI), the SAT Eco-Venture and Bio products research consortium. The AIC is part of the state government's Genome Valley Project, the ABI provides advice and technical assistance to fledgling biotech companies, whilst the third is an eco-tourism venture in partnership with the state government while the fourth is a consortium along similar lines as those in the consortia discussed above.

6.4 The case studies and other agricultural PPPs

This section now turns to locating the two case studies within other agricultural PPPs, partnerships in the CG system and in the respective Centres. The aim of this is two fold: to strengthen the analysis of the two case studies by using parameters and indicators used in previous studies and existing literature and secondly, to draw any implications, similarities and differences, in so far as this is possible, between the case studies and other PPPs in agriculture.

Table 6.8: Rationales of the ICRISAT and ILRI case studies

	ICRISAT	ILRI
Economic rationale	+	+
Wider participation	-	-
Complexity of modern problems	+	+++
Synergy and complementarity	+++	+++
Accessing new resources & skills	+	+++
Saving costs	+	-

The data collected from the fieldwork indicates that the 'synergy and complementarity' rationale ranks first across both case studies. Complexity of modern problems is more relevant as a rationale to the ILRI case study than to the ICRISAT consortia. Similarly, accessing new resources and skills is more important to the ECF project than to the ICRISAT consortia. Wider participation as a rationale plays no role in both case studies while saving costs and reacting to market failure are of limited influence in both case studies.

In the Spielman *et al.* study discussed below (Figure 6.4), the goal of accessing new scientific knowledge ranks higher than other goals for frontier research partnerships. This is consonant with the fieldwork findings: accessing new resources and skills ranked highly in the ECF project which is an example of a frontier research PPP. The study found that the goal of reducing costs was not cited in frontier research but was cited in commercialisation and sector development partnerships. The case studies bear this out: saving costs is not a rationale for the ECF project although it is a rationale, albeit a weak one, for the ICRISAT consortia which are examples of commercialisation PPPs under Spielman's classification.

Empirical literature on PPPs generally takes two approaches: analysis of existing data sets on PPPs[31] and the use of case studies often based on geographic region or a commodity. Studies on agricultural PPPs have tended to follow the latter.[32] A review of the literature on agricultural PPPs shows that most involve agricultural biotechnology[33] and technology transfer.[34] Analysis has been mostly from an innovation system perspective, or from other

[31] Roa-Atkinson, A. & Velho, L. North-South partnerships in agricultural biotechnology: a pilot database, UNU/MERIT Technology Policy Briefs 3/1 (2004) 3; see also Velho, L., 'North-South, public-private partnerships in biotechnology: Relevant issues and implications for developing countries' UNU/MERIT Technology Policy Briefs 3/1 (2004) 1 who uses both analytical approaches in developing a pilot database against which PPPs in Kenya (Ikiara, M. & Njogu, J., 'Agricultural biotechnology partnerships in Kenya' UNU/MERIT Technology Policy Briefs 3/1 (2004) 6), Tanzania (Mello, D. & Mneney, E., 'Agricultural biotechnology partnerships in Tanzania' UNU/MERIT Technology Policy Briefs 3/1 (2004) 8 and Uganda (Nsubuga-Muyonjo, F., 'Agricultural biotechnology partnerships in Uganda' UNU/MERIT Technology Policy Briefs 3/1 (2004) 10) are tested;

[32] See for example Pray, C., Public-private sector linkages in research and development: biotechnology and the seed industry in Brazil, China and India, *Amer. J. Agr. Econ.* 83/3 (2001) 742 on agricultural biotechnology and in the seed industry in Brazil, China and India; Hartwich, F., Gonzalez, C. & Vieira, L., 'Public-private partnerships for innovation-led growth in agrichains: a useful tool for development in Latin America?' ISNAR Division Discussion Paper no. 1 (Washington DC: IFRPI, 2005) and Hartwich, F., Gottret, M., Babu, S. & Tola, J., 'Building public-private partnerships for agricultural innovation in Latin America: lessons from capacity strengthening' IFPRI Discussion Paper no. 00699 (Washington DC: IFPRI, 2007) who examine PPPs in Latin America using 124 projects in one study and 7 in another; see also Ayele, S., Chataway, J. & Wield, D., Partnerships in African crop biotechnology, *nature biotechnology* 24/6 (2006) 619 who use Kenya as a case study in examining the contribution PPPs in food crop biotechnology make towards achievement of the UN's Millennium Development Goals (MDGs). They conclude that biotechnology partnerships are poorly oriented to end users, fragmented in scope and have limited impact in achieving the UN MDGs

[33] See for example Barry, G. & Horsch, R., 'Evolving role of the public and private sector in agricultural biotechnology for developing countries' in Persley, G. & Lantin, M., (eds.) *Agricultural biotechnology and the poor: proceedings of an international conference, Washington DC 21-22 October 1999* (Washington DC: CGIAR, 2000); Graff, G., Roland-Holst, D. & Zilberman, D., Agricultural biotechnology and globalisation: the role of public and private sector research, paper presented at 'The workshop on Environmental Costs and Benefits of Transgenic Crops in Europe' 2-4 June (2003); and Kameri-Mbote, P., Wafula, D. & Clark, N., *Public private partnerships for biotechnology in Africa: the future agenda* (Nairobi: ACTS Press, 2001)

[34] Rausser, G., Simon, L., & Ameden, H., Public-private alliances in biotechnology: can they narrow the knowledge gaps between rich and poor? *Food Policy* 25 (2000) 499; Spielman, D., Cohen, J. & Zambrano, P., Policy investment, and partnerships for agricultural biotechnology research in Africa: Emerging evidence, *ATDF Journal* 3/4 (2006) 3; Byerlee, D. & Fischer, K., Accessing modern science: policy and institutional options for agricultural biotechnology in developing countries, *World Development* 30/6 (2002) 931; and also

perspectives such as constraints to PPPs,[35] value addition,[36] regulation,[37] maximising incentives to the private sector,[38] while others provide a prescription for successful partnerships.[39]

This dominance of certain areas in agricultural PPPs is reflected in the case studies. The ECF vaccine project is clearly on biotechnology and both projects are essentially technology transfer projects: the ICRISAT consortia involve the transfer of technology mainly from the public to the private sector although feedback loops are integrated into the structure of the project while the ECF vaccine project involves technology transfer to and from both the private and public partners: Oxford University provides the technologies for vaccine development as does Merial Ltd, ILRI's long standing research on *T. parva* benefits other partners and the partnership and TIGR's sequencing of T. parva is transferred to the partners.

6.5 The case studies and PPPs in the CGIAR

The CGIAR interest in PPPs became entrenched in 1995 with the establishment of two partnership committees – the Non-Governmental Committee (NGOC) and the Private Sector Committee (PSC) whose specific aim was to act as catalysing forces in advancing the number and quality of CG's development partnerships. In 2004, the CG commissioned a study to

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Parker, D., Castillo, F. & Zilberman, D., Public-private sector linkages in research and development: the case of U.S. Agriculture, *Amer. J. Agr. Econ.* 83/3 (2001) 736

[34] Velho, L., North-South collaboration and systems of innovation, *IJTMSD* 1/3 (2002) 171; see particularly Hall *et al.* (2001) *supra* note 23; Hall *et al.* (2003) *supra* note 29; Hall, A., 'Public private sector partnerships in an agricultural system of innovation: concepts and challenges' UNU/MERIT Working Papers (Maastricht: United Nations University/Maastricht Economic and Social Research and Training Centre on Innovation and Technology, 2006); Hall, A., Capacity development for agricultural biotechnology in developing countries: an innovation systems view of what it is and how to develop it, *Journal of International Development* 17 (2005) 611; and also Clark, N., 'Innovation Systems, Institutional change and the new knowledge market: implications for Third World agricultural development' UNU/INTECH Discussion Papers (Maastricht: United Nations University/Maastricht Economic and Social Research and Training Centre on Innovation and Technology, 2001)

[35] Spielman, D., Agricultural sector investment and the role of public-private partnerships, paper presented at 'The African Development and Poverty Reduction: the Macro-Micro Linkage Conference' South Africa 13-15 October (2004)

[36] Huffman, W., Public-private research and development relationships: discussion, *Amer. J. Agr. Econ.* 83/3 (2001) 754

[37] Pongsiri, N., Regulation and public private partnerships, *International Journal of Public Sector Management* 15/6 (2000) 487

[38] Naseem, A., Omamo, S. & Spielman, D., 'The private sector in agricultural R&D: policies and institutions to foster its growth in developing countries' ISNAR Division Discussion Paper no. 6 (Washington DC: IFPRI, 2006)

[39] Henson-Apollonio, V., 'Collaborative agreements: a 'how to' guide' ILAC Brief 4 (Rome: CGIAR Institutional Learning and Change Initiative, 2005)

examine the performance of the two committees. The study did not look at PPPs in the CG but recommended that the CG address this directly.[40]

Various studies have analysed PPPs in the CG generally and specifically. Manicad inquires into how the CG's public good goal is reconciled with private sector profit objectives in PPPs.[41] Binenbaum, Pardey and Wright suggest a method of analysing inter-organisational relations between the CG and the private sector[42] while Spielman and Grebmer conduct an analysis of the challenges facing the private sector and the CGIAR in agricultural research and argue that the 'willingness and ability of agencies to enter into partnerships are constrained by fundamentally different incentive structures.'[43]

There have been case studies conducted on specific PPPs involving the CG Centres. These include Gowda *et al.* who describe the origin, rationale and development of the ICRISAT – PS consortia[44] and Smith's analysis of the ILRI ECF Vaccine project.[45]

Like studies on agricultural PPPs, studies on PPPs in the CG Centres have been fragmented tending to be CG Centre specific, project specific, commodity specific or region specific. This is probably due to the context specific nature of PPPs. There are only a handful of system level studies on PPPs in the CGIAR. These include a study conducted by the CGIAR Science Council Secretary on collaborations in 14 CG Centres with other organisations[46] and a more recent study by Spielman, Hartwich and Grebmer on 75 projects involving all the CG

[40] Bezanson, K., Narain, S. & Prante, G., *Independent evaluation of the partnership committees of the CGIAR : Final report* (Washington DC: CGIAR, 2004)
[41] Manicad, G., CGIAR and the private sector: public good versus proprietary technology in agricultural research, *Biotechnology and Development Monitor* 41 (1999) 8
[42] Binenbaum, E., Pardey, P. and Wright, B. Public-private research relationships: The Consultative Group on International Agricultural Research *Amer. J. Agr. Econ.* 83/3 (2001) 748
[43] Spielman, D. & Grebmer, K., Public-private partnerships in international agricultural research: an analysis of constraints, *Journal of Technology Transfer* 31/2 (2006) 291
[44] Gowda, C., Reddy, B., Rai, K. & Saxena, K., ICRISAT collaboration with the seed industry in Asia, paper presented at 'The Asian Seed Congress' Seoul, 13-17 September (2004); see also Reid, D., Bussiere, D. & Greenaway, K., Alliance formation issues of knowledge-based enterprises, *International Journal of Management Reviews* 3/1 (2001) 79
[45] Smith (2005) *supra* note 18; also Egelyng, H., Evolution of capacity for institutionalised management of intellectual property at International Agricultural Research Centres: A strategic case study, *AgBioForum* 8/1 (2005) 7 on the International Rice Research Institute's (IRRI's) capacity to manage IP; Patino, B. & Best, R., Strategic alliances of cassava farmers with private and public sectors: a new approach for development of the cassava crop in Latin America, paper presented at 'The 9th Japan International Research Centre for Agricultural Sciences (JIRCAS) International symposium' Japan 16-17 October (2002) on the Latin American and Caribbean consortium to support cassava R&D under the International Centre for Tropical Agriculture (CIAT)
[46] CGIAR Science Council Secretariat, *CGIAR centre collaboration: Report of a survey* (Washington DC: CGIAR, 2006)

Centres.[47] These two studies form the basis of the following brief analysis of PPPs in the CGIAR. The section does not claim to provide an exhaustive report on all PPPs in the CG or indeed all the findings from the studies; rather, it provides insights as to where the two case studies sit within other PPPs in the CG.

6.5.1 The Science Council study

The CG Science Council study assessed collaboration between 14 CG Centres and other organisations including the private sector. The study was conducted between November 2004 and June 2005. The study reported 3395 organisations with which CG Centres collaborate.[48] The findings relevant to this section are summarised:

(a) 78 percent of the organisations with which the CG Centres collaborate are located in developing countries; this observation is borne out by the ICRISAT Consortia where, with the exception of two MNCs, all participants are located in India. In contrast, only two (Kenya Agriculture Research Institute and the Department of Veterinary Services) of ILRI's seven partners in the ECF vaccine project are located in Kenya. Majority of ILRI's partners in the project are from the North. The study however did not disaggregate the share of local collaborators: one cannot tell what percentage of these is from the private sector. It may well be that the share of local private sector collaborators is not as high as 78% which might validate the ECF project but not the ICRISAT Consortia. Institutions based in developed countries are the CG's *most important* collaborators (Figure 6.2) followed by those in developing countries. The private sector is the third most important collaborator for the CG Centres. This finding is resonates with the case studies although the respective projects reflect this differently.

(b) The national agricultural research institutes in developing countries, universities and non-governmental organisations in developing countries comprise about 60 percent of the organisations with which Centres collaborate;

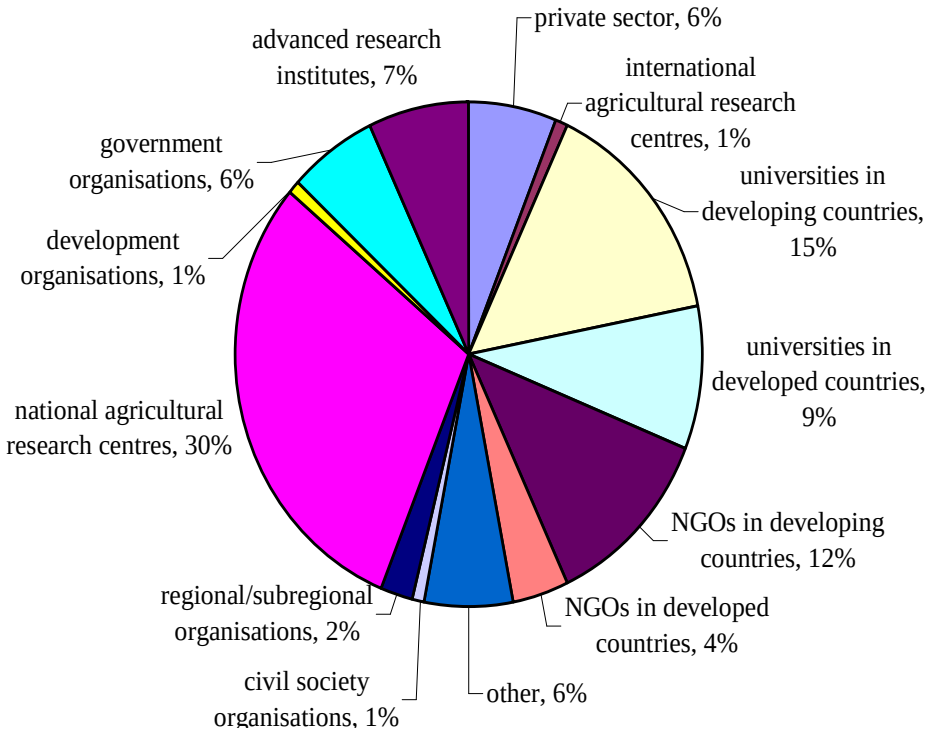
(c) Contrary to the widely held view that collaboration with institutions in developed countries does not play an important role in the CG system, the study showed that 57

[47] Spielman, D., Hartwich, F. & Grebmer, K., 'Sharing science, building bridges, and enhancing impact' IFPRI Discussion Paper 00708 (2007)

[48] A caveat on the data available is that the high variability in the number of collaborating organisations among the Centres was mainly due to the Centres' interpretation of 'collaboration', the method of data collection by individual Centres as well as perhaps the different collaboration strategies adopted by the Centres

percent of organisations deemed to be especially relevant in collaboration with the Centres were universities, agricultural research institutes and non-governmental organisations in developed countries;

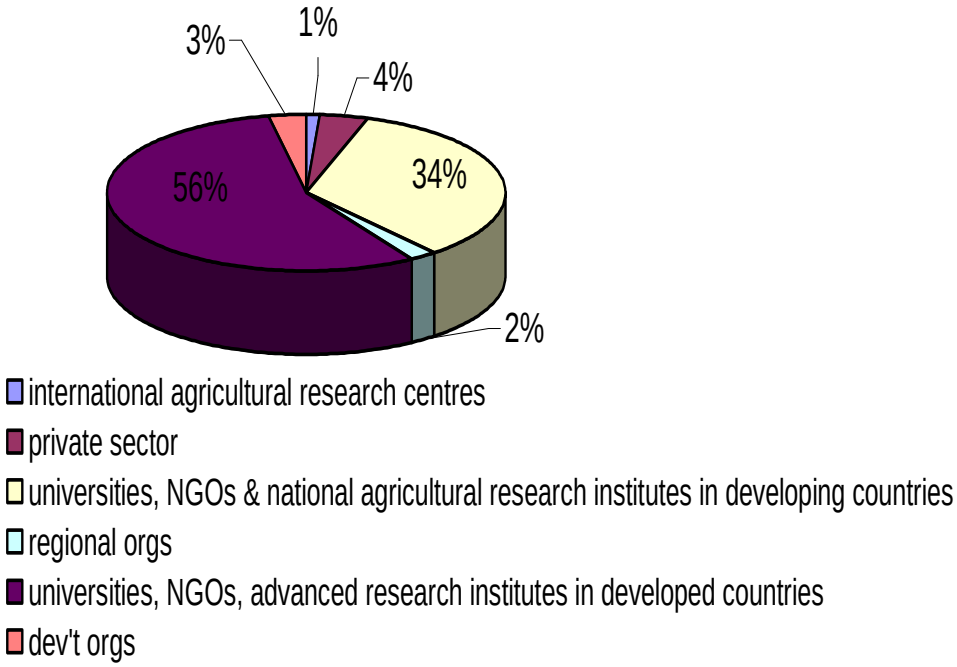
Figure 6.1: Types of organisations with which the CG Centres collaborate



Source: CGIAR Science Council Secretariat (2006)

(d) In contrast, the private sector was mentioned as a key collaborator by only 4 Centres. The private sector participated in *only 6 percent* of the collaborations; two of these were in the field of biotechnology and two involved plant breeding efforts mainly with seed companies; the main presence of the private sector in biotechnology and plant breeding is reflected in the two case studies.

Figure 6.2: Most important collaborations with CG Centres by type of organisations



Source: CGIAR Science Council Secretariat (2006)

(e) The reasons for collaboration as given by the Centres were (i) providing access to critical expertise or material resources; (ii) as a strategy for leveraging additional human resources; (iii) facilitating testing and dissemination of information, technologies or policies; (iv) taking advantage of the collaborators' previous experience in the field; (v) to enhance the capacity of Centre's staff; and (vi) enhancing funding prospects. An analysis of the results shows that the reasons for collaboration correlate with the type of collaborator e.g. additional expertise was the most frequently cited reason for collaboration with institutions in developed countries while dissemination and testing was what motivated collaboration with organisations in developing countries. This is resonant with the case studies: accessing new resources and skills was cited more in the ECF vaccine project (where partners are mainly from the North) than in the ICRISAT consortia (which involves mostly local seed companies) while dissemination of research was a motivation in the latter case study but not in the former.

6.5.2 The Spielman, Hartwich and Grebmer study (SHG study)

Spielman *et al.*[49] look specifically at PPPs in the CGIAR. The study identified 75 PPPs active from 2004. The relevant findings can be summarised thus:

(a) 57 percent of the PPPs are collaborations that include foreign entities; an equal number and proportion of PPPs include domestic entities with the overlap between the two categories comprising only 5 percent of the PPPs. This finding resonates with the ICRISAT Consortia: it involves local seed companies and two multinationals although in different proportion from that in the SHG study.

(b) PPPs in the CG are mainly exclusive (60 percent), meaning they involve the private sector to the exclusion of other public sector or civil society organisations. This is particularly true of the ICRISAT Consortia; no public sector parties or CSOs are involved. The same can however not be said of the ECF project which involves four public sector parties from the North.

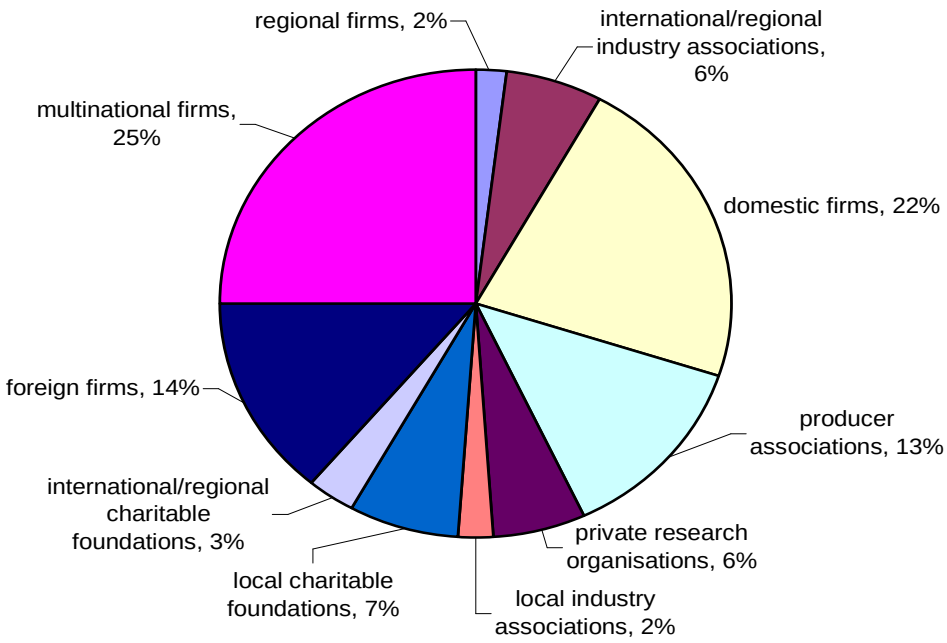
(c) Many PPPs are also 'monogamous' (43 percent) meaning they involve just one Centre and one private sector partner. Most of the 'monogamous' PPPs (21 of the 32) involve foreign entities 9 of which involve multinational firms.

(d) Reasons for the existence of the PPPs were grouped as (i) sectoral or value chain development (ii) resourcing (iii) contracting (iv) commercialisation; and (v) frontier research;

(e) The *goals* of the PPPs were identified as (i) bring the Centre into closer contact with the poor (9 PPPs) (ii) translate research outputs into products for the poor (47) (iii) reduce costs by partnering with the private sector (21); and (iv) access new scientific knowledge from the private sector (24)[50]

[49] Spielman, Hartwich & Grebmer (2007) *supra* note 47
[50] A note on the study states that the data includes reports of multiple goals

Figure 6.3: Private sector partners in the CG system by type

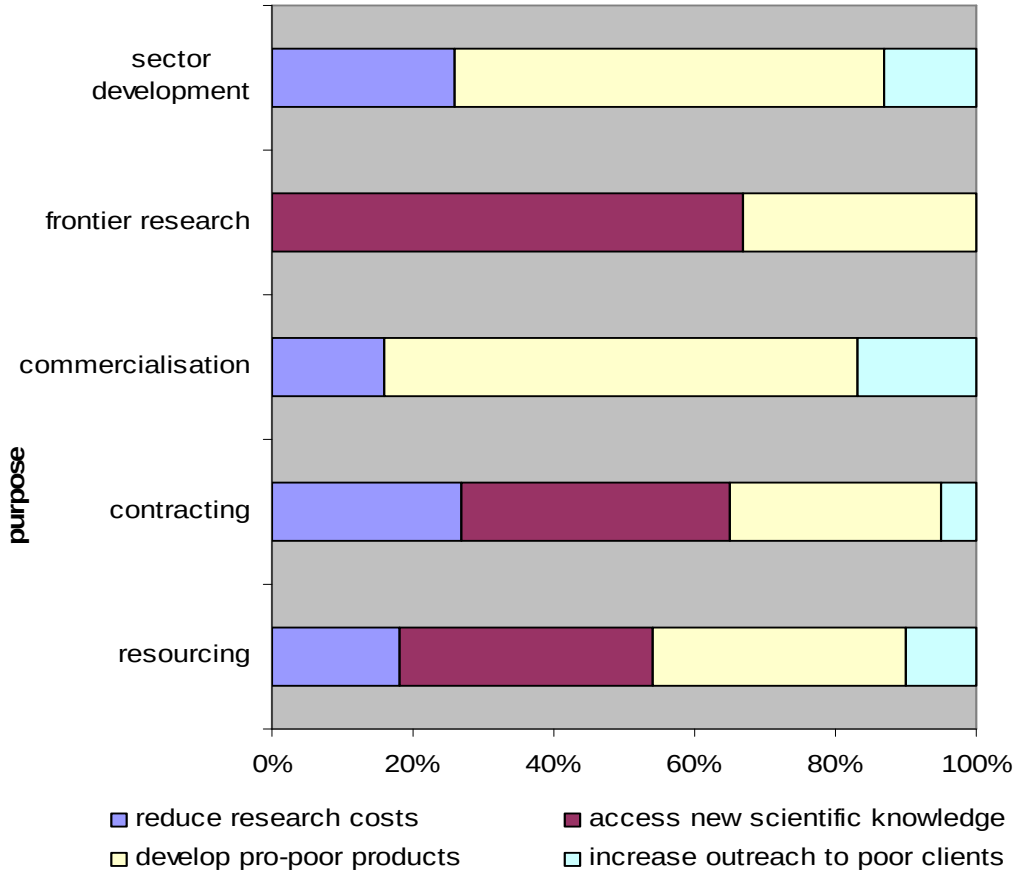


Source: Spielman, Hartwich, & Grebmer (2007)

(f) Superimposing the goals onto the purposes shows that PPPs in the CG are relatively concentrated in 3 areas: (i) commercialisation to develop pro-poor products (ii) frontier research to access new scientific knowledge and (iii) sectoral or value-chain development of pro-poor products. Juxtaposing the case studies against this, the ICRISAT-PS consortia matches the concentration areas (i) and (iii) while the ECF project seeks to access new scientific knowledge through frontier research (Figure 6.4)

(g) Notably, the goal of reducing research costs was not cited in frontier research PPPs. The Science Council study found that funding considerations rarely motivated Centres' key collaborations even with institutions in developed countries. This is true of the ECF project; cost reduction was not cited as a motivation for collaboration.

Figure 6.4: Goals and purposes of surveyed PPPs in the CG



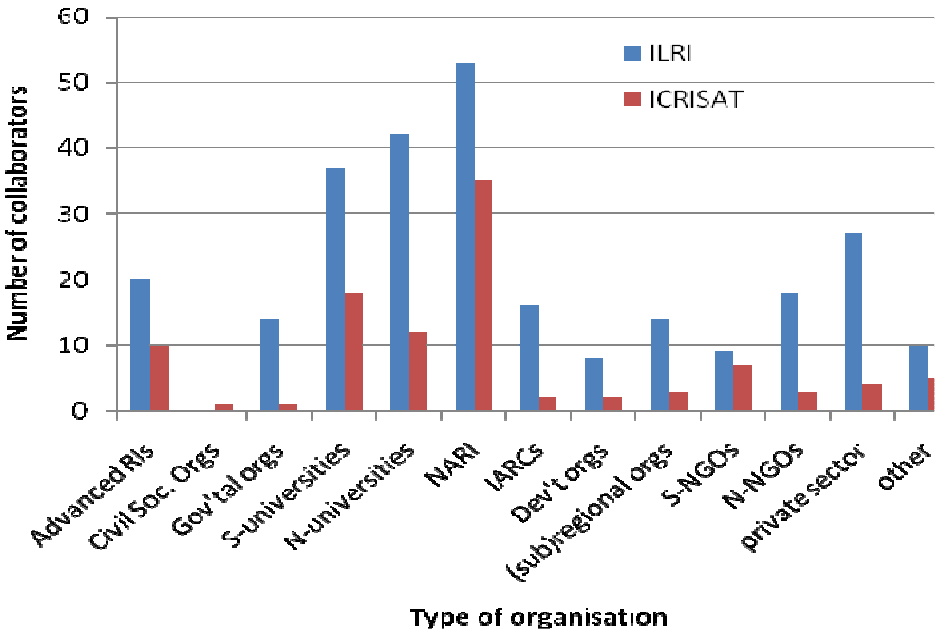
Source: Spielman, Hartwich, & Grebmer (2007)

6.6 PPPs in ILRI and ICRISAT

Both Centres have a long history of collaboration with other partners. In the Science Council study, ILRI was found to have 268 collaborators during the study period, 27 of whom were with the private sector. ICRISAT had 103 and 4 respectively.

The study found that CG Centres have minimal collaboration with the private sector relative to collaborations with other actors such as national agricultural research institutes; private sector organisations at 4% represented only a small share of the Centres' highly relevant collaborations. ICRISAT was one of only four Centres that referred to the private sector as a highly relevant collaborator.

Figure 6.5: ILRI's & ICRISAT's collaborators



Source: CGIAR Science Council Secretariat (2006) with modifications

Although the private sector constituted only 4% of ICRISAT's collaborations, this however does not equate to the number of PPPs involving ICRISAT. The fact that the private sector was cited as a highly relevant partner suggests that the quality of ICRISAT – private sector engagement is more important than the number of private sector collaborators involved. Funding and aims of PPPs has a large bearing on ICRISAT's perception of the importance of collaborating with the private sector. Collaborators from the private sector constitute 10% of all collaborations with ILRI; this suggests that ILRI has considerable experience in engaging with a large number of private sector partners although the fact that the private sector is not considered one of ILRI's highly important collaborators reinforces the argument that the quality of partnership contributes more to the institution's perception of a collaboration's importance; the number of private sector collaborators an institution engages with matter less.

The findings suggest that ILRI-private sector collaborations are of lesser quality than those between ICRISAT and the private sector. It might also be that relative to other collaborations involving the respective Centres, ILRI's collaborations with the private sector matter less while ICRISAT places more importance on collaborations with the private sector. Table 6.1 shows the Centres' respective share of investment in policy and in collaborations and partnerships. More research would increase understanding on the link between the Science

Council findings and the investments made by the respective Centres with regard to collaborations and partnerships.

The SHG study identified 75 PPPs active in 2004 or later; eleven of these involved ICRISAT and represented 15% of all CG PPPs while ILRI was involved in only 4 PPPs. The discrepancy between the two studies may be due to a number of factors: the method of data collection, the time period covered and the different definitions of collaboration and partnerships employed. It may also be the case that ILRI's 4 PPPs (according to SHG) have a high concentration of private sector organisations while ICRISAT's few private sector collaborators (according to the Science Council study) were involved in multiple PPPs. The distribution of the private sector organisations is difficult to establish as the studies do not give a breakdown of the constituents of the PPPs. The author's field work established at least 53 private sector companies involved in three consortia in ICRISAT in 2005. This is way above the 4 identified in the Science Council study.

A number of inferences can be drawn from the above mapping exercise. Firstly, the case studies differ from each other in terms of the number, constitution, roles and level of engagement of the partners involved, the organisational structure and design of the PPPs, rationale, the activities, achievements and impacts to date. Secondly, the case studies reflect the agricultural areas in which the private sector typically engages: agricultural biotech and plant breeding. In this regard, the case studies can be said to be typical agricultural PPPs. Thirdly, the rationale for the case studies matches that of most PPPs in the CG. Convergence of synergies is the predominant rationale for the two case studies. There are differences in the ranking of rationales across the two case studies; this resonates with findings from other studies on PPPs in the CG. Partnerships in different areas will be influenced by different rationales: for example, accessing new resources and skills is more influential as a rationale to frontier research partnerships such as ECF than to commercialisation PPPs like the ICRISAT consortia.

6.7 IP policies

The following section conducts a similar exercise albeit regarding IP related policies. It seeks to establish firstly, how the respective Centres' IP related policies are influenced by the Centres' membership to the CGIAR system. Secondly, it analyses the policies to determine

whether they are creative enough to mitigate the excludability effect of IPRs and thirdly, it examines how the respective policies affect collaboration between the Centres and the private sector.

6.7.1 ILRI's IP policy

ILRI has a broad policy covering IPRs, biosafety and bioethics. Its provisions are premised on the international public goods nature of research that ILRI conducts. ILRI's outlook seems to be relatively progressive:

> "ILRI's scientific work, while respecting the general scientific principles of good faith and the search for truth, is guided by its particular humanitarian and equity-based concerns, *and not by a morally neutral pursuit of knowledge for its own sake*." (Emphasis added)

This represents a shift from the traditional concept of public scientific research as knowledge creation or basic research to an applied research, needs-driven approach. This pragmatism is also reflected in the recognition that IP protection on ILRI's products and technologies may be necessary. The policy lists such instances as when IP protection is required to

(i) ensure continued availability of germplasm, information, inventions, publications and databases to ILRI's clients
(ii) prevent misappropriation of ILRI's material by others for profit making
(iii) ensure the delivery of improved products and technologies in developing countries
(iv) negotiate access to other proprietary rights and technologies required for product development

The spirit embodied in these conditions clearly resonates with that in the policies at the CG system level. Chapter four looked at the conditions applied by the system level policies; for example, according to the CG Guiding Principles, one instance when Centres can seek IP protection is in order to 'assure ready access by others to research products developed or funded by the Centre'; this is clearly reflected in ILRI's policy ((i) and (iii) above). Similarly, the CG Guiding Principle condition that IP protection may be sought to 'facilitate the negotiation and conclusion of agreements for access to proprietary technologies' and to

‘ensure the Centre’s ability to pursue its research, together with its partners, without undue hindrance’ is similar to (iv) above.

The Guiding Principles emphasise that IP protection should not be seen as a means for securing financial returns; ILRI’s IP policy similarly states that ‘its research will continue to be supported with public funds and that it should not look to profit from any of its products or genetic materials.’ It can be clearly seen that the international public goods nature of ILRI’s research as influenced by its membership to the CGIAR is reflected in its IP policy.

International public goods and food security is mentioned three times in a relatively short policy. ILRI’s vision for a ‘world made better for poor people in developing countries by improving food security and agricultural systems in which livestock are important’ is reiterated. Elsewhere, the policy states that ‘ILRI’s research produces international public goods aimed at alleviating poverty, increasing food security and protecting the environment… and working through collaborative partnerships.’

The policy is yet to be updated in light of the agreement between the Centre and the International Treaty’s Governing Board. It still refers to the situation pertaining before ILRI joined the FAO International Treaty on PGRFAs. The policy therefore employs the traditional division of genetic resources into pre and post CBD ex situ collections. The distribution of the former is to be consonant with the provisions of the 1994 FAO/ILRI agreement which requires the use of a Material Transfer Agreement (MTA) for germplasm exchange. The IP policy provisions under this head are therefore necessarily similar to those in the FAO/ILRI MTA. Both stipulate that a recipient of ILRI’s ex situ pre-CBD germplasm collection are prohibited from claiming ownership over the material received, or seek IPRs over the germplasm, its *genetic parts* or components or related information. ILRI’s IP policy omits ‘genetic parts’ implying that these may be protectable; however, it may be argued that the use of the term ‘components’ includes genetic and other parts of the germplasm and therefore adding ‘genetic parts’ is redundant.

Both the FAO/ILRI MTA and ILRI’s IP policy require of recipients to ensure that any subsequent person or institution to whom/which they pass on samples of the germplasm is bound by the same provisions. The IP policy goes further by requiring the recipient to inform ILRI of such transfer of germplasm. The IP policy contains a disclaimer on safety, quality,

viability, genetic and mechanical purity and accuracy of passport or other data of the germplasm and passes on the responsibility to comply with national biosafety and import regulations to the recipient. This is almost a verbatim repetition of the FAO/ILRI MTA.

On post-CBD ex situ germplasm collections, ILRI's policy is guided by principles of the CBD such as respect for national sovereignty and prior informed consent. The policy states that clear MTAs 'setting out the terms and conditions of acquisition, benefit sharing and any future transfer and use of the material' will be signed between ILRI and the national government. This is a departure from the standard MTA used for transfer of pre-CBD ex situ germplasm and would presumably be on a case by case basis.

The IP policy covers biological resources from ILRI's research activities. These are to be made available under an MTA and in accordance with the CBD. The policy states that the centre-bred materials or components of the material are to be used for research or academic purposes only; use for commercial purposes must be authorised by ILRI and where applicable, its partners. Publication of any results obtained through the use of ILRI bred material likewise requires ILRI's authorisation and must include appropriate acknowledgements to ILRI. Similar to the requirement regarding designated material, the recipient is likewise prohibited from claiming ownership over the material or components of the materials received from ILRI or to seek IPRs over those materials, components and derivatives of the materials or related information.

On products developed through advanced technologies including biotechnology, any kind of information, invention or biological material developed by ILRI is to be made freely available in the public domain *provided it does not include proprietary technology*. However, this unfettered availability may be limited for confidentiality reasons 'to ensure continued availability to developing nations.'

Collaborative partnerships are a main theme in ILRI's IP policy. Relations with the private sector are to be governed by memoranda of agreements signed between ILRI and the respective institution. The policy stipulates that confidentiality agreements and MTAs are to be used in such cases to 'clearly define access to and use of information and materials between ILRI and the private sector.' ILRI's policy considers IP conditions attached to donor funds and provides that 'ILRI will instruct staff on the limitations to use of any proprietary

materials in the research and conditions set by donors on applying intellectual property protection to products resulting from research funded by these donors.'

With regard to other proprietary matter of a non-PGR nature, the policy is straightforward. This is expected given the non contentious nature of other subjects of IPRs such as copyright, trademarks and service marks. The policy addresses this as succinctly as it does scientific and agricultural equipment designs; it however provides that for these, ILRI will strive to ensure that the scientific and agricultural designs are available to developing nation partners and farmers *at a minimal reasonable cost*.

The policy pays significant attention to confidentiality agreements. All dealings with other institutions are to be governed by a confidentiality agreement (CA). Visitors need to sign a CA before access to any information or technology developed by ILRI is permitted. However, this is not necessary if the information or technology is already in the public domain.

Employees are bound by the ILRI personnel policy manual which covers IP and confidentiality. Conditions required of employees include:

(i) Obtaining prior informed consent before disclosure of any information on ILRI research or establishment of formal collaboration outside ILRI especially with the private sector. It is not clear whose consent should be sought; the presumption is the Director General or a member of senior management authorised to give consent

(ii) maintaining accurate and detailed records at all steps of research especially where proprietary materials are used

(iii) maintaining laboratory books in a manner ensuring that research is confidential and that claims for any IP protection can be supported; laboratory books are not to be removed from ILRI's premises

All discoveries, products and technologies developed or made at ILRI remain the property of ILRI and may not be removed, exploited or sold without authorisation from the Director General. The IP policy requires all publication pertaining to such materials 'to be cleared' by the Director General or his nominee before publication.

Read as a whole, the following observations can be made of ILRI's IP policy. Firstly, it is clearly premised on the international public goods nature of ILRI's research in which

achievement of food security is paramount. This is a direct influence of policies at the CG system level. Secondly, the policy is at pains to articulate the situations where IP protection may be allowed and even required even if ILRI conducts public goods research. Again, these situations reflect those stipulated by the system level guiding principles. However, the policy is somewhat pro active; it states one situation where IP protection is necessary as 'to prevent misappropriation of ILRI's material by others for profit making.' This does not appear anywhere in the system wide Guiding Principles. ILRI appears to recognise that it holds intellectual assets eligible for protection and is prepared to seek IPRs defensively to prevent third parties from taking advantage of its public goods oriented research. This is clearly progressive. Thirdly, the policy pronounces that ILRI's work is guided by 'particular humanitarian and equity-based concerns, and not by a morally neutral pursuit of knowledge for its own sake'. This seems to be, as well as the public goods nature of ILRI's research, the ration d'être for the type of IP policy ILRI has. The appreciation of the need for applied, user-defined and resource-poor driven research is implicit in the policy's attempt to balance its public goods mandate and the protection of IP.

Fourthly, ILRI's IP policy clearly envisages collaboration with the private sector. Collaborative partnerships and stakeholder participation generally are a main theme of the policy. The policy is capable of mitigating the excludability effect introduced by IPRs. This is explicit in statements such as 'to make advanced technologies and techniques available to developing countries, ILRI may apply intellectual property protection or limitations on the publication and distribution of the derived and associated materials.'

All in all, ILRI's IP policy seems comprehensive enough to address the usual IP issues that a typical IARC is likely to face. There is due recognition of the fact that the policy on IP is a working document likely to be revised as and when needs arise. It is flexible enough to allow ILRI to engage in collaborative research with the private sector without compromising its mandate. The policy's implementation is another case altogether. Like all other policies and guidelines, the proof of its efficacy is in its implementation. It is to be expected that with such a policy, ILRI would be more likely to seek IPRs and more amenable to IPRs generally than other Centres, such as ICRISAT discussed below, would. However, proving this is beyond the scope of this thesis.

6.7.2 ICRISAT's IP Policy

In comparison to ILRI, ICRISAT's IP policies are spread across various documents. The main policy has seven annexes including the CG Guidelines. In addition, there are five other IP policy related documents 3 of which are standard material transfer agreements for materials ranging from ICRISAT material 'under development', software and genetic material developed by ICRISAT. Table 6.1 showed an increase in ICRISAT's investment in policy from 2004; it could be possible that the numerous policy documents are an outcome of the increased prioritisation of policy in ICRISAT. There are inconsistencies and even contradictions in these policy documents.

As do all CG Centres, ICRISAT generates international public goods and its policy is necessarily premised on this. Quoting the belief that access to ICRISAT's outputs should be fair and equitable, the policy states that 'as its basic policy, ICRISAT pursues *publication and full disclosure and the open sharing* of ICRISAT data, information and knowledge through the release of ICRISAT research findings and products into the public domain.' This is clearly different from ILRI's 'non pursuit of knowledge for its own sake' mantra.

The policy recognises the rights of third parties when using their material in research. The policy does not require recipients and users of technology, knowledge, data and any information originating from ICRISAT to publicly acknowledge the Institute as the source of such knowledge, technology, data and information. When it comes to using technology, knowledge, data and information from third parties, the policy states that ICRISAT 'will acknowledge and obtain appropriate permission for the use of others' data, knowledge and technology.' The policy also states that ICRISAT does not condone wilful infringement of any legitimate and legally established rights held by third parties. It appears that the policy is pre occupied with not infringing the rights of third parties and does not seem to recognise the value of ICRISAT's own intellectual assets in the same way that ILRI's policy does.

On the management of IP, ICRISAT's policy is dated in that it still refers to FAO's International Undertaking rather than the International Treaty. The policy was effective from March 2002 before the International Treaty entered into force and is possibly why reference is to the International Undertaking.

The policy states that ICRISAT uses MTAs and Germplasm Acquisition Agreements to facilitate access and ensure 'continued free exchange' of genetic material. The policy reiterates that this is to ensure that materials are maintained in the public domain. The policy does not seem to appreciate the difference between the existence and the exercise of IPRs. For example, it states that "ICRISAT has traditionally adhered to a policy of unrestricted availability of germplasm… in the interest of keeping this material available for future research and utilisation, ICRISAT has undertaken… not to claim legal ownership … or to seek any intellectual property rights over that germplasm or related information." The policy presumes that seeking IPRs and ensuring access are at odds and does not seem to consider how this may be resolved.

The instances in which ICRISAT may protect the products of its research are listed as:

(i) to support public and private partnerships which pursue mission-based research and/ or which develop and apply research results;

(ii) to ensure ready access by others to research products developed by ICRISAT and its partners;

(iii) to avoid restrictions arising from protection by others and to facilitate pursuance of its mission;

(iv) to facilitate the uptake of research products and their impact on the poor including, where appropriate, through commercialisation;

(v) To facilitate the negotiation and conclusion of agreements for access to proprietary technologies of use to ICRISAT and in the furtherance of its mission.

ICRISAT reserves all rights to its research including all data, laboratory, field notebooks, formal and informal reports and products. Employees are not allowed to claim IPRs arising out of their work at ICRISAT. All inventions and innovations made while at ICRISAT are to be assigned to the Institute by employees, visiting scientists, research fellows and other partners. These parties are required to sign agreements to that effect as a condition of their association with ICRISAT.

The policy portrays ICRISAT as actively intervening where access to IP held by third parties is restricted but required for the benefit of developing countries. In such cases, the policy states that ICRISAT will engage the private sector, universities, advanced research institutes, national agricultural research systems and other organisations to access resource products for

the benefit of the poor. The policy states that 'any arrangements with third parties associated with access, joint creation, use of and exploitation of intellectual property protected materials or technologies will be properly researched.' There is no indication of what this would entail and what parameters would be used to 'research' such an arrangement. Another instance where ICRISAT is cast in an intervening role is in the effort to secure freedom to operate for innovators. It is not clear how ICRISAT is to achieve this and who the 'innovators' are. There is no mention of ICRISAT's own freedom to operate with regard to proprietary technology owned by third parties.

The policy addresses other issues such as trademarks and copyright. With regard to the latter, the policy permits the reproduction of ICRISAT materials 'in a manner consistent with fair use.'

The policy refers to the use of a MTA for transfer of ICRISAT bred material. The MTA is standard in nature and governs the transfer of all ICRISAT bred material. The MTA states that transfer of the material is not exclusive to the recipient i.e. ICRISAT can transfer it to other entities. The transferred material is however for the exclusive use of the recipient who is not permitted to claim ownership over the material nor seek IPRs, over the material or its genetic parts or components 'in the form received'. It is not clear what this means. Presumably, if the recipient further develops the material, he may seek IP on the final product as it will no longer be 'in the form received'. A footnote to the condition reads that if the recipient commercialises this material or a product that is a plant genetic resource for food and agriculture which incorporates this material, the recipient is obliged to pay into the mechanism established under article 19(3)(f) of the International Treaty. Where the product is available for further research and breeding to others without restriction, the recipient who commercialises it is encouraged rather than obliged to make such payment.

Recipients are not permitted to transfer the material to third parties. The MTA requires the material obtained from ICRISAT to be used for research, breeding and training purposes only. National apex gene banks are however allowed to transfer material to third parties without ICRISAT's authorisation. The MTA includes a disclaimer as to the safety or title of the material, its quality, viability or purity of the material transferred. Additional passport data is available on request. Recipients of ICRISAT bred material are obliged to provide ICRISAT with related data and information collected during evaluation and utilisation of the material.

On reading all the IP policy documents, it appears that the policy employs different standards for different categories of materials. Looking at the six different classes covered in the policies and MTAs (designated germplasm; centre bred germplasm; breeding materials under development; ICRISAT developed micro organisms and antibodies; DNA, RNA and sequence data; and software) IP protection is weakest for designated germplasm, stronger for centre bred material and materials under development and strictest for DNA and sequence data. ICRISAT and third parties are not allowed to seek IPRs for designated material at all. IPRs may be sought by third parties for software, micro organisms and antibodies, and material under development provided the material is not 'in the form received'. Similarly, third parties can seek IPRs for centre bred material and DNA, RNA and sequence data but only on written permission from ICRISAT.

The same disparity in standards applies with regard to exclusivity; for designated material, software and centre bred material, recipients are allowed to transfer the material to other third parties provided the terms in the transfer agreements are passed on to the third parties. For breeding materials under development, micro organisms and antibodies and RNA, DNA and sequence data, recipients cannot transfer the material to other third parties.

The provisions in the policy and MTAs are inconsistent and even contradictory. For example, the MTA for ICRISAT developed microorganisms and antibodies requires third parties to request and receive material directly from ICRISAT while the MTA for ICRISAT developed Genetic Material, which presumably includes microorganisms and antibodies allows recipients to transfer the material to third parties.

At some level, ICRISAT's IP policy is progressive in so far as attempts are made to address areas such as DNA, RNA and sequence data which are not covered by the International Treaty. The fact that this occurs in the absence of an un updated IP policy (which still refers to the International Undertaking) buttresses the suggestion that ICRISAT's approach to IP policy making is piece meal and reactionary rather than comprehensive and focussed. This is also reflected in the different levels of 'strength' accorded to the various categories of material. For example, the relatively new DNA, RNA and sequence data is subject to stricter control as is the material under development. It could be said that this is a direct influence of the SMTA under the International Treaty.

On the whole, ICRISAT's IP policy seems to take a defensive approach; it is arguably more preoccupied with an awareness of IP not to protect its technology but rather to avoid infringing the rights of third parties. That the involvement of the private sector in agricultural research has heightened the IARCs' awareness of IP and related issues is evident from ICRISAT's policy. References to IP protection are made (i) to prevent misappropriation of ICRISAT's material by the private sector; (ii) to enable partnerships with the private sector; and (iii) as tools of leverage with third parties including the private sector. The different standards apparent in the various categories of materials makes ICRISAT's overall IP policy read as lacking focus.

ILRI's IP policy substantially differs from that of ICRISAT. Both are influenced by their membership to the CG system. The differences in the policies might be attributed to these factors: firstly, the CG system is an alliance of IARCs. As discussed earlier, it has no legal status and Centres are not legally obliged to adopt system wide policies although all Centres generally adopt these out of goodwill. Secondly, the CG Guidelines on IP are themselves broad enough to accommodate various perspectives that may be taken by respective Centres. This has resulted in ICRISAT adopting a somewhat left leaning IP policy while ILRI's is more appreciative of the IP motivations of potential partners including the private sector. There are currently efforts to amend, update and streamline the Guiding Principles in a more focused manner and to develop an unambiguous common CG IP policy that will translate to similar IP policies across the Centres. CG Centres are divided on this move as some consider themselves more 'progressive' IP-wise and argue for IP polices that will allow the Centres to take a more pro-active approach in protecting their intellectual assets. [51]

Both policies display an appreciation of the excludability effect introduced by applying IPRs in the provision of public goods. The ICRISAT policy appears to mitigate this fiercely by adopting a rather left leaning defensive approach. It makes the assumption that IP protection equates to limiting access of products to its end users. ILRI's policy on the other hand seems more appreciative of the distinction between the existence and exercise of IPRs. It appears to take into account private sector motivations while being supportive of its own mission. Like ICRISAT, it provides for mitigation of the excludability effect although less fiercely.

[51] The International Rice Research Institute (IRRI) is one such centre; Science Council, pers. comm.

6.8 Centres' policies on partnerships with private sector

At a system level, the CGIAR does not have consolidated guidelines on the Centres' engagement with the private sector. Guidance for this is contained in various documents some of which include:

1. CGIAR Mid Term Meeting (May 1998)
2. Principles involving Centre interaction with the private sector and others (revised July 2003 version)
3. The Guiding Principles under the Scientific and Know-How Exchange Programme (SKEP) Between the CGIAR Centres and the private sector (Feb 2005)
4. Guidelines for Centre models of collaboration with the PS (May 2005)

A brief analysis of each follows:

6.8.1 The CGIAR MTM

This contains various references on PS engagement although these are within the context of genetic resources, proprietary technology and biotechnology rather than PS engagement generally. The MTM also clarifies the policy making structure so that the guidelines and policies adopted are collective Centre policies rather than CGIAR policies. As such, it appears that there is no clear CG policy on PS engagement; what exist are guidelines adopted by the collective Centres.

The MTM in proposition 5 recognises the role of PS engagement particularly with regard to biotechnology and addresses the issue of proprietary technology resolving that material developed jointly or otherwise should not be encumbered by proprietary claims so as to hinder release to NARS.

The System Review in developing its long-term vision and strategic perspective suggested that the CG should consider forming essential partnerships in applied research 'focusing on needs and what is realistically possible.' The MTM recognised the importance of collaborating with partners stating that the CG's 'future actions will have to be elaborated in alliance with many partners.' It is presumed that partners here include those from the PS.

The Report of the Panel on General Issues in Biotechnology underscored the need to balance CG's activities in dealing with the PS in the field of biotechnology while that of the Panel on Proprietary Science and Technology considered whether owners of proprietary agricultural biotech which includes the PS, would make their proprietary science available.

6.8.2 Principles involving Centre Interaction with the Private Sector and Others

The Guidelines and Statements on Genetic Resources, Biotechnology and Intellectual Property Rights were adopted by the MTM in 1998 and revised in July 2003. These are collective Centre policies rather than CGIAR policies.

The book of policies makes various references to PS engagement the most relevant of which is the 'Principles Involving Centre Interaction with the Private Sector and Others.' These principles recognise the increasing importance of the PS in 'the invention and development of materials and advanced technologies that could be applied to the CGIAR goals'. It lists the mutual benefits of such collaboration are. It also suggests various forms the collaborations may take.

The Principles state that collaboration with the PS should be in accordance with the CGIAR Ethical Principles Relating to Genetic Resources and the Guiding Principles on IP and Genetic Resources. The former has as the main principles Equity, Trusteeship, Social Benefits and Respect, Responsibility and Integrity; while the latter addresses issues such as IP protection, farmer's rights, defensive protection and Centres' access to materials protected by others. The Centres are allowed to secure finances from commercialisation of proprietary technology by its partners with the requirement that such funds shall be ploughed back into research.

These attempt to keep collaboration with the private sector in check in order to avoid situations where a 'foreseeable reduction of local communities' access to and benefits from genetic resources might occur'. The Principles reiterate that all research and partnerships should be for the public good.

6.8.3 The Guiding Principles under the Scientific and Know-How Exchange Programme (SKEP) Between the CGIAR Centres and the PS

SKEP's main objective is stated as promoting technology and knowledge transfer in designing, managing and controlling R&D processes and projects through the exchange of staff between the CG Centres and the private sector and is therefore an example of a form of PS engagement. The Programme recognises the importance of public-private partnerships and states the mutual benefits.

The SKEP Guiding Principles cover organisation, financing, bilateral cooperation, confidentiality and non-disclosure, inventions, indemnifications, assignment, termination and resolution of disputes. They seem more like an agreement rather than a statement of *guiding principles.* They make no reference to other guiding principles such as the CG ethical principles relating to Genetic Resources, CG Guiding Principles on IP and Genetic Resources or Principles involving Centre Interaction with the private sector yet these are of direct relevance. It appears there are multiple guiding principles, which, while not conflicting, are not linked to each other. This emphasises the need to have a comprehensive general policy on collaboration with the private sector from which all other guiding principles should stem.

6.8.4 Guidelines for Centre models of collaboration with the PS

Perhaps these are an attempt to integrate the various policies and guidelines into one set of guidelines; although they fail to state their relationship with other guidelines. They state that collaborations should be entered into in order to 'enhance the capability of a Centre to deliver to its stakeholders and collaborators the best quality science aimed at meeting the Centre and CGIAR objectives and goals' and that fund raising should not be the focus for collaboration with the private sector.

The Guidelines underscore the importance of informing 'major research partners'; these are presumed to mean donors or governments and not the private sector.[52] The Guidelines are categorical that Centres should engage the PS only if it complements and enhances a Centre's

[52] Stating that '…best efforts should be exercised to ensure that the *major partners* are well informed of the arrangements with the private sector.' and 'where other *major research partners* have been directly involved in research and related activities of relevance to the private sector partnership, best efforts should be exercised to obtain agreement of these partners before entering into arrangements with the private sector.' (emphasis added)

ability to achieve its mandate more quickly and efficiently; they require that the terms of collaboration should be consistent with the delivery of global public goods.

The Guidelines require collaborations to be governed by binding legal contacts clearly defining the parties' rights and obligations. They also state that good business practices should be followed. The Guidelines state that Centres 'will not accept funding from private companies that could reasonably create a conflict of interest' but fall short of defining what would be a *reasonable* conflict of interest.

The Guidelines are tailored to allow for 'flexibility of approach, creativity in interaction, and a clear commitment to the overall goals and nature of the CGIAR system' although as a whole, they do not explicitly acknowledge the importance of the PS as other previously discussed guidelines do.

6.8.5 Centres' policies on engagement with the private sector

Neither ILRI nor ICRISAT has a general policy on collaboration with the private sector. Both Centres' IP policies anticipate collaboration with the private sector especially in biotechnology research in the case of ILRI whose IP policy states that

> 'ILRI recognises that it may need to form partnerships with the private sector to ensure continued availability and delivery of information and inventions. In order to promote delivery of product, where necessary ILRI will establish linkages with the private sector in the early stages of development of products.'

The policy falls short of providing guidelines on such collaboration save to state that the partnerships are to be governed by memoranda of agreement, confidentiality agreements and MTAs 'to clearly define access to and use of information and materials between ILRI and the private sector.'

ICRISAT's IP policy mentions partnership with the private sector and has a brief Code of Conduct for Interaction with the Private Sector as an annex. The Code of Conduct begins with an acknowledgement that

> ‘ICRISAT recognises the increasing importance of the private sector in the invention and development of materials and advanced technologies that could contribute to ICRISAT’s mission.’

The Code of Conduct lists the instances where ICRISAT may work with the private sector as licensing of products and technologies and developing and delivering new technologies to the poor in developing countries. It states that ICRISAT will adhere to policies and procedures for the conservation and use of genetic resources and biodiversity as defined under the terms of the CBD, the FAO-ICRISAT Agreement and the FAO International Undertaking.

The Guidelines under the ICRISAT-PS consortia address issues such as financial contributions, the rights and obligations of parties and operational aspects. In addressing the detail of the consortia, they - like the SKEP Guiding Principles - are more like an agreement rather than a statement of principles.

There does not seem to be an integrated concise policy document on engagement with the private sector both at the CG system level and at ILRI and ICRISAT level. However, the various guidelines and policy statements are consonant with the CG goals and contain the resounding theme of complementarity of synergies for mutual benefit and particularly for more efficient delivery of Centres’ technology to the poor in developing countries. The various guidelines and policies seem to appreciate the mutual benefits of collaboration, some more explicitly than others.

A reading of the provisions on private sector engagement shows complementarity of synergies as the basis for collaboration between the Centres and the private sector. This is clearly borne out in the findings from the case studies and in other studies conducted on PPPs in the CG system.

There perhaps should be a general policy at the CG level and at the centre level enunciating the main principles to be considered in all partnerships with the private sector. From these principles, the Centres can subsequently formulate individual agreements tailored for each partnership. Currently, at least in the case of ICRISAT, there appears to be the latter but not the former.

6.9 Conclusion

The CGIAR Centres are legally independent each with its charter, constitution, research responsibilities and mandates. They are however linked by their membership to the CGIAR. Although having individual programmes, projects, themes and mandate crops, the Centres' research falls under the general CGIAR focus areas and is based on the CG's mission of which the attainment of food security is paramount.

The adoption of ILRI's and ICRISAT's policies on IP was as a result of a system wide recognition of the increasing significance of IPRs to the CG Centres. Although the policies differ in attitude and scope, they are both influenced by and conform to the CGIAR Guiding Principles on IP. The respective policies envisage partnership with the private sector and provide for the occasions where IP protection by the Centres is necessary. They also provide for mitigation of the excludability effect of IPRs; the policies in both Centres are premised on the public goods nature of their research.

There is no consolidated policy on partnership with the private sector both at a CG system level and at centre level; ICRISAT however has a brief Code of Conduct for Interaction with the Private Sector. PPPs involving the CG Centres are therefore occurring in a policy vacuum. However, this does not seem to have had a negative impact on the case studies: the two PPPs are governed by tailor made agreements between ICRISAT, ILRI and their respective partners.

Both ICRISAT and ILRI have previous experience with PPPs although not to the scale of the respective case studies. The two PPPs are ongoing and have already had considerable positive impact mostly on the Centres' organisational culture and practice. Both projects are demand led and represent a shift from the erstwhile technology led research prevalent in most public research institutes. The parties in the ECF PPP are confident that the project is on track to deliver a vaccine while improved hybrids are already under commercialisation under the ICRISAT-PS consortia.

Chapter Seven

The role of IP in the case studies

7.0 Introduction

Although the two case studies differ in many aspects, the lessons learnt in both are invaluable to understanding the challenges facing food security oriented PPPs. This chapter aims at elucidating these challenges, how they come about and how parties in the PPPs deal with them. Its ultimate objective is to investigate the significance of intellectual property to the partnerships.

This chapter uses a thematic approach in analysing the case studies. It looks at the nature and characteristics of the PPPs, the factors motivating the respective partners into joining the PPPs and the differing perspectives on IP and how these affect the partnerships.

It uses the process of partnership building – the formation stage, the negotiation of the partnership arrangement, and the execution of the partnership – to assess the significance of IP in the case studies. The chapter also considers the impact of Kenyan and Indian IP law on the ECF project and on the ICRISAT-PS consortia respectively and outlines other IP related issues and challenges faced by the two case studies and how they are dealt with. Data obtained from interviews with key informants during the fieldwork forms the bulk of the information in this chapter.

7.1 The problem with agricultural research in the development context

Chapter one identified six overlapping theories on the formation of PPPs (Table 1.1). The dominant rationale behind the formation of food security oriented PPPs was found to be exploiting synergies among the partners. Other rationales include gaining access to valuable partner-held resources, and minimising costs and risk. The overlapping rationales stem from the classic problem plaguing agricultural research in the development context: the public sector produces excellent research but most of it ends up on the ‘technology shelf’ as it is not

applied; the private sector possesses plenty of applied skills but use these solely for commercial gain; funding is available from donors but the donor community is increasingly wary of funding research out of which there is no return or impact. Modern complex agricultural development problems suffer as a result of this 'tension' pulling the sectors away from each other. The two case studies are examples of how the respective partners attempt to address this.

7.2 Nature and characteristics of the partnerships

Several classifications have been proposed to conceptualise and categorise PPPs. Classification of PPPs is a difficult task given their context specificity. There exists no blueprint for PPPs; various taxonomies have been employed in attempts at classifying PPPs. Taxonomic properties include the nature of knowledge or technology involved, the flow of that knowledge or technology, the form and extent of collaboration, the distribution of risk between the partners, the specific roles played by respective partners, the institutional organisation of the partnership, the objectives of and reasons for the PPP, the ownership of the PPP, the source of funding and the nature of the PPP's activities. Whilst not an exhaustive list, this illustrates the various diverse ways used for classifying PPPs. This section analyses the case studies based on the ownership and flow of knowledge and technology and the extent of collaboration. Technology in this case includes both tangible technology such as seeds and final products as well as intangible technology such as knowledge and intellectual assets including intellectual property.

In the ICRISAT–PS consortia, private seed companies make grants to ICRISAT and in exchange, they obtain access to ICRISAT developed and improved germplasm subject to the conditions in the MTA and other relevant agreements. The flow of tangible (seeds) and intangible (IP) knowledge and technology flows from ICRISAT to the private seed companies. This has been termed by some as commercialisation partnerships: the public sector transfer research findings and materials to the private sector which multiplies, markets and distributes the transferred technology.[1] However, the ICRISAT-PS consortia relationship is not as simplistic as the linear flow of technology and information implies.

[1] Hall, A., Sulaiman, R., Clark, N., Sivamohan, M. & Yoganand, B., 'Public-private sector interaction in the Indian agricultural research system: an innovation systems perspective on institutional reform' in Byerlee, D. & Echeverría, R., (eds.) *Agricultural research policy in an era of privatisation* (Oxon: CABI Publishing, 2002);

Differentiating between the public and private sectors' organising principles, Hall *et al.*[2] posit that the former's research organisation is linear moving from public research to the technology shelf to the private sector to the farmers. Hall *et al.* contrast this linear organisation with the private sectors' technology system which, they argue, comprises a diverse set of competencies and resources. These relate to the product itself (in the case of the consortia, hybrid seed) and a profit and market orientation which together define the elements required to produce the end product profitably. The elements may be technical and include managerial capabilities and processes as well as physical inputs and infrastructure; all these features make up the 'technology system.'

To the private sector therefore, the consortia do not only transfer the technology but ICRISAT's expertise as well as strategic resources and infrastructure. Hall *et al.* write

> "While superficially it may appear that the private sector actually seeks a physical input of technology from ICRISAT in the form of advanced breeding lines, this is an oversimplification. The private sector views this as an issue of accessing the expertise of ICRISAT – in combination with its genetic resources and research infrastructure – and directing this expertise so that it contributes to the technology systems of individual private companies. In other words, the consortium mechanism is a way of ensuring that the private-sector company can include the capabilities and resources of a public-sector organisation like ICRISAT as part of its own technology system."[3]

While not expressing the partnership as holistically, private sector consortia members interviewed identified the close working relationship with ICRISAT as an integral part of the consortia; some even suggested that it was just as important as the improved seed that they received.[4] The flow of technology and information relates not just to the tangible technology (improved germplasm) but also to the expertise which is intangible and is part of ICRISAT's

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see also Spielman, D., Hartwich, F. & Grebmer, K., 'Sharing science, building bridges, and enhancing impact' IFPRI Discussion Paper 00708 (2007)

[2] Hall, A., Sulaiman, V., Clark, N. & Yoganand, B., 'Shared perspectives: a synthesis of obstacles and opportunities' in Hall, A., Yoganand, B., Sulaiman, R. & Clark, N., (eds.) *Sharing perspectives on public-private sector interaction: proceedings of a workshop, 10 April, 2001, ICRISAT, Patancheru, India* (New Delhi & Patancheru: NCAP & ICRISAT, 2001)

[3] Id. at p38

[4] Private sector consortium members, pers. comm.

intellectual assets. However, the private seed companies have some input on the improved germplasm. Being closer to the market, the companies provide valuable feedback to ICRISAT which informs the traits that ICRISAT focuses on in its plant breeding efforts. The flow of information in this regard is from the private sector to ICRISAT. This illustrates that the ICRISAT-consortia relationship is more than the mere private distribution of public goods.

ILRI's ECF project is more clearly a collaborative partnership with multi-directional flow of information, knowledge and technology. Both sectors in the ECF project pool resources to take advantage of complementary skills, infrastructure and proprietary science. The research carried out although linear (in the way that gene sequencing and annotation follows gene discovery and so on) involves multiple input from both sectors. These are involved in all stages of research and development perhaps with the exception of the initial 'basic research' stage. The difference in the parties' complimentary skills is demonstrated by the role that the parties play at each stage of research. For example, TIGR, LICR & ILRI were the main participants at the gene discovery stage, ILRI took the lead in the proof-of-concept stage while Merial and KARI take the lead at the product development and trials stage. The flow of knowledge and technology in this partnership has been to and from both sectors at all stages of the collaboration. This type of partnership has been termed by some as frontier research partnership where partners jointly undertake research activities characterised by some unknown probability of success.[5]

The ECF project is a multilevel, multifaceted and multilayered collaborative PPP. This is contrasted with the ICRISAT-PS consortia. In the latter, the consortia members do not have any contractual agreement with each other although the intangible networks between and among the members as a result of belonging to the same consortium should not be overlooked. The consortia members join the consortium by entering into an agreement with

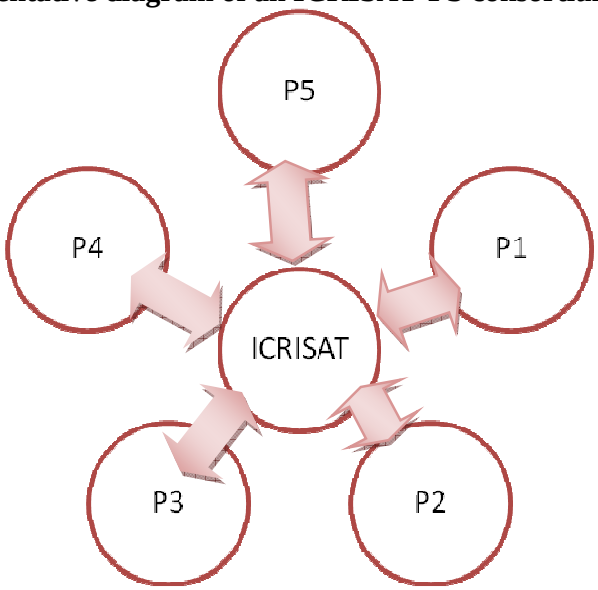
[5] Spielman, Hartwich & Grebmer (2007) *supra* note 1 classify PPPs in their CG study according to the role played by the sectors, the objective of the collaboration and the distribution of risk among the partners. They arrive at five categories of PPPs: (i) resourcing partnerships where the CG Centres receive funding from philanthropic organisations associated with private firms or they receive scientific expertise from private firms; (ii) contracting partnerships where the CG Centres facilities or expertise are contracted to private firms or vice versa; (iii) commercialising partnerships where CG Centres transfer research findings and materials to private firms for commercialisation, marketing and distribution; (iv) frontier research partnerships where the CG Centres jointly undertake research activities characterised by some unknown probability of success; and (iv) Sector or value chain development partnerships where the CG Centres collaborate with networks of public, private and civil society partners to develop a commodity subsector or its associated value chain.

ICRISAT only. This makes membership to the consortia and its organisation and execution flexible. This is crucial to the functioning of the consortia.

> 'The decision to have this design and flexibility was conscious. We wanted to make the consortia accessible to everyone who was interested in joining it. If we made it more rigid, it would increase the costs of running the consortia and might have deterred potential companies from joining us.' [6]

One can see how this loose design was probably the best arrangement to achieve the consortia aims. Requiring consortia members to enter into legal agreements with each other might have been problematic. The private seed companies are in competition with each other and might have been reluctant to be in direct partnership with each other under the terms of the consortia. Being in partnership with ICRISAT only allows each of the companies to maintain the confidentiality of the materials that they access from ICRISAT; this might not have been possible if the seed companies were in direct partnership with each other as direct partnership implies the open exchange of knowledge and information.

Figure 7.1: Representative diagram of an ICRISAT-PS consortium

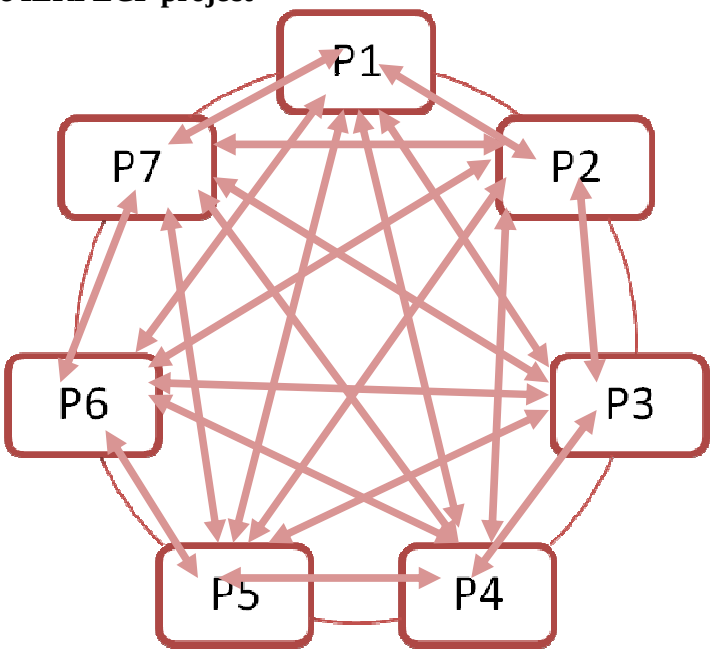


In contrast, the ECF project is governed by a master agreement which incorporates all partners and states their roles, rights and obligations. The nature of the collaborative research further strengthens the bond between the partners.

[6] ICRISAT, pers. comm.

The ECF project can be seen as a combination of a variety of multilevel, crisscrossing partnerships with multiple, multi-directional flow of technology. On deconstruction, the individual relationships between the partners are examples of different types of collaborations. For example, to the extent that ILRI received scientific expertise from TIGR in the form of the *T. parva* genome sequence, the ILRI-TIGR relationship could be said to be a resourcing partnership where the public sector receives scientific expertise from private firms.[7] This relationship could also be termed as a contracting partnership as ILRI 'contracts' TIGR's expertise. However, ILRI and TIGR jointly undertook the annotation of the genome – the identification genes and the assignment of gene functions, although most of the annotation was performed by ILRI's bioinformatics specialists.[8] In this regard, this relationship is a frontier research partnership.

Figure 7.2: The ILRI ECF project



The ILRI-Merial relationship likewise qualifies under different forms of partnerships. To begin with, Merial brought into the partnership a vaccine delivery system which was already patented. In this regard, this relationship is a resourcing partnership as ILRI received technology from Merial. Secondly, the ILRI-Merial relationship could also be considered as 'contractual' as Merial's expertise in vaccine delivery is used in the PPP. Thirdly, Merial has

[7] Spielman, Hartwich & Grebmer (2007) *supra* note 1
[8] TIGR & ILRI, 'U.S. /African project deciphers deadly parasite genome' available at http://www.ilri.org/ilripubaware/uploaded%20files/TIGR_ILRI_ECF_Press_Release.pdf

a wealth of knowledge in vaccine development and production; this is evinced by the Merial's assignment to the lead role in the product development stage; Merial undertakes to commercialise market and distribute the final vaccine.

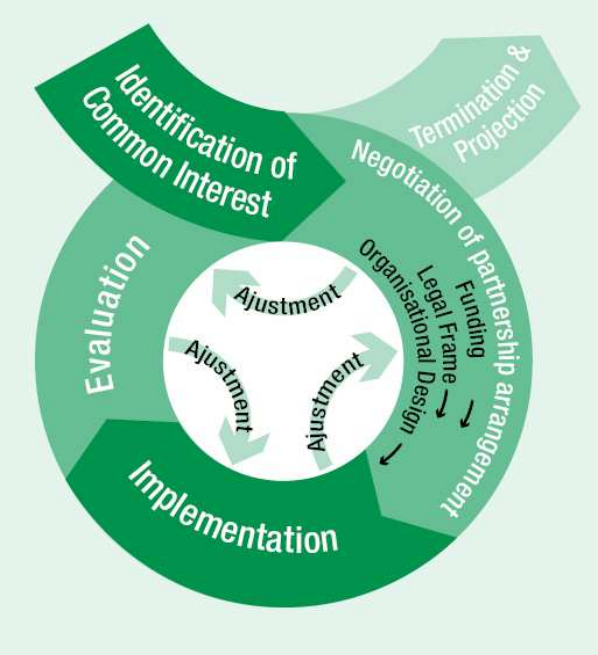
Merial and ILRI undertook joint research at the proof-of-concept stage – Merial's delivery system was modified and used to demonstrate the induction of the candidate antigens. This part of the relationship qualifies for a frontier research partnership. At the clinical trials stage, Merial will be collaborating with ILRI and other local networks notably KARI to determine among other things, the dose, safety and efficacy. In this regard, the relationship could be seen as a sector or value chain development partnership.

From the deconstruction exercise, it is clear that the ECF project is more complex than the ICRISAT-PS consortia. The multi-directional flow of technology is not limited to ILRI and the respective partners; the partners also have a relationship with each other although ILRI is the coordinator. It is possible to replicate the deconstruction in the context of the other partners. Having a master agreement that would link all the parties was essential to the functioning of the partnership. The alternative would mean each partner having as many agreements as the membership of the project which would not make any sense as any research agreement between two parties would impact on other project members and on the partnership's goal and outcomes.

7.3 The role of IP in the case studies

The stages of a generic partnership provide a useful starting point in analysing the role that IP plays in food security oriented PPPs. The following analysis looks at the first three stages in a partnership and is based on data obtained from interviews during the field work. The partnership formation stage includes the identification of common interest and the factors motivating parties to enter into a partnership. Relating to these, the interviews with the parties in the respective case studies sought to determine firstly, what motivated the interviewee institution or firm to collaborate with the partners in the respective projects; secondly, the criteria used in choosing partners for collaboration and finally, what part, if any, IP played in influencing the decision to be part of a partnership and the choice of partners.

Figure 7.3: The cycle of partnership



Stage 1: Identification of common interest (formation/creation stage)

Stage 2: Negotiation of partnership arrangement

Stage 3: Implementation/execution of the partnership

Hartwich et al. (2007)

The role that IP plays in negotiating the respective partnerships governing documents is the main focus in the second stage of the partnership. In the third stage of the partnership, the section looks at the role that national IP legislation has on the execution of the case studies. Also relevant to this stage, the interviews with the key informants sought to establish if IP was among the key factors important in execution of the respective case studies.

7.3.1 IP in stage 1: IP in the creation of the PPPs

7.3.1.1 General motivational factors

Understanding the profit objective of the private sector is key in exploring the factors influencing the formation of partnerships with the public sector. In agricultural research and development, the Consultative Group on International Agricultural Research (CGIAR or CG) is an obvious potential partner for the private sector. To begin with the exception of one centre, all CG centres have their headquarters and main operations in Africa, Asia and Latin America. For the private sector, partnering offers access to these markets some of which would probably be harder to penetrate.

In addition to taking advantage of the CG's global presence, the private sector would benefit from the goodwill enjoyed by the CG Centres and the Centres' broad understanding of local agricultural knowledge systems. The CG provides an attractive international network for field testing plant varieties including transgenic crops. In this regard, the private sector could potentially gain access to the global network of non-profit and development related agricultural research that the CG is part of.

Although the CG's collection of ex situ germplasm comprises only 15% of the estimated 3.8million samples held worldwide, this collection represents close to 40% of the unique food germplasm.[9] Cooperation with the CG would therefore potentially enhance the private sector's access to unique germplasm.

Dryden confirms that one of the private sector's interests in cooperating with the CG is that this could potentially lead to the development of a new market: those small scale farmers in transition to fuller participation in the market economy.[10] The CG could assist the private sector in further expanding their businesses in economies that are undergoing liberalisation such as India.

For small domestic private firms, partnership with the CG could help reduce costs and maximise profits. A recent study examining the role of PPPs in international agricultural research found that PPPs with the CG provide small domestic firms with opportunities to 'access new technologies that can significantly enhance their product lines…'[11]

Binenbaum, Pardey and Wright[12] suggest that private firms 'donate' proprietary inputs to the public sector or to a PPP for two primary reasons: to gain access to the public sector's connections with networks of public and non-profit organisations (or indeed other private firms) and secondly, the potential of the research leading to valuable information for example the crossing and testing of crop varieties in different agroecological environments leading to information of value to subsequent crop improvement efforts.

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[9] Manicad, G., CGIAR and the private sector: public good versus proprietary technology in agricultural research, *Biotechnology and Development Monitor* 41 (1999) 8
[10] Sam Dryden, the then chair of US Emergent Genetics Inc. as quoted in Id. at p2
[11] Spielman, Hartwich & Grebmer (2007) *supra* note 1 at p40
[12] Binenbaum, E., Pardey, P. & Wright, B., Public-private research relationships: the Consultative Group on International Agricultural Research, *Amer. J. Agr. Econ.* 83/3 (2001) 748

Philanthropy and or altruism are sometimes quoted as reasons why the private sector 'helps' the public sector by entering into partnership with the latter. The more accurate argument is that the private sector does so for positive publicity i.e. to increase their public profile. Most private sector representatives interviewed were not coy about this.

According to Jacques Barman, the president of the Swiss Novartis Foundation, 'where people grow, profits grow…'[13] This shows that what are sometimes termed as humanitarian efforts are actually linked with a good business sense on the part of the private sector. Such PR strategies are premised on the understanding that a good public profile has positive commercial implications.

Bovaird posits that companies are increasingly paying more attention to their corporate social responsibility: 'there is now evidence… that many companies, while continuing to be profit-oriented, are interested in, and even committed to, taking more seriously the 'corporate social responsibility' aspects of their activities.'[14]

Kettler and Towse[15] add influencing policy making as a reason why the private sector may choose to enter into a PPP. This echoes the summary offered by Buse and Walt: increased corporate influence in global and national level policy making; direct financial returns in the form of cash and tax breaks and market penetration; indirect financial benefits through brand and image promotion; and enhanced corporate authority and legitimacy through association with public bodies.[16]

In agricultural R&D, major investments by private companies in research including biotechnology make them obvious partners for the public sector. Cooperating with the private sector enables the public sector build capacity in research particularly in biotechnology in developing countries. Mugabe and Clark argue that it is not so much the 'privately biased' nature of R&D that is responsible for the failure of developing countries to uptake technology

[13] Quoted in Manicad, G., CGIAR and the private sector: Public good versus proprietary technology in agricultural research, *Biotechnology and Development Monitor* 37 (1999) 8 at p2
[14] Bovaird, T., Public-private partnerships: from contested concepts to prevalent practice, *International Review of Administrative Sciences* 70/2 (2004)119 at p213
[15] Kettler, H. & Towse, A., *Public-Private Partnerships for Research and Development: Medicines and Vaccines for Diseases of Poverty* (London: Office of Health Economics, 2002)
[16] Buse, K. & Walt, G., Global Public-private partnerships: part II- What are the health issues for global governance? *Bulletin of the World Health Organisation* (2000) 78/5 699

and build capacity. They in fact point out that alliance with the private sector is vital to gaining access to biotechnology capacity.[17]

Table 7.1: Motivational factors influencing decision to be involved in a partnership

Incentive/motivational factors which mostly apply to the private sector	*Incentive/motivational factors which mostly apply to the public sector*	*Incentive/motivational which apply to both sectors*
• Gain access to markets where the public sector already has activities (in the case of the CG, take advantage of its global presence) • Tap into potential markets e.g. those small scale farmers in transition to fuller participation in the market economy • Benefit from the good will enjoyed by the public sector • Take advantage of the public sector's knowledge and expertise e.g. understanding of local agricultural knowledge systems • gain access to the public sector's connections with networks of public, non-profit & private organisations • Gain access to public sector's technology e.g. the unique germplasm held by CG Centres; and basic research which has the potential to lead to valuable information e.g. the crossing and testing of crop varieties in different agro ecological environments leading to information of value to subsequent crop improvement • reduce costs and maximise profits especially for small domestic private companies • PR (indirect financial benefits through brand and image promotion) • enhanced corporate authority and legitimacy through association with the public sector • corporate social responsibility • direct financial returns in the form of cash and tax breaks • Influence policy making at national & global levels	• Save public funds • Build capacity in research • Tap into private sector's skills and expertise • Gain access to private sector's technology whether protected or not • Gains access to the private sector's management principle of organisational efficiency • Acquire more business credibility and authority	• Benefit from each other's comparative advantage • take advantage of existing synergies • Benefit from each other's skills and expertise • Gain access to each other's technology • Save costs

By collaborating with the private sector a public research organisation is able to tap into the former's skills and expertise. This in turn enhances the latter's capacity to deliver public

[17] Mugabe, J. & Clark, N., Technology transfer and the Convention on Biological Diversity: issues of conservation and sustainable use, *Science, Technology and Development* (1996) 14/3

goods and services.[18] The public sector also gains access to the private sector's management principle of organisational efficiency. This may help in improving efficiency in the delivery of public goods and services. Partnership with the private sector also bestows on the public sector more business credibility and authority.[19]

For both sectors, engaging in partnership may save respective costs. For the public sector this is particularly relevant given the declining or stagnant levels of public research funding particularly in developing countries. Through PPPs, private funding is mobilised to provide public services: 'governments are keen to shift more welfare provision into private hands to keep public spending under control and to avoid having to raise taxes or cut benefits.'[20] By forming a PPP, the private sector absorbs a greater share of the costs than it would if the project was run solely by the public sector. The converse is also probable particularly in food security agricultural PPPs which are often funded by donors. In this case, the private sector benefits from subsidised research costs.

7.3.1.2 Motivational factors in the case studies

ILRI ECF project

Public sector's perspective

The Third System Review of the CGIAR carried out in 1998 called for greater partnership with the private sector. Although this might partly explain why ILRI decided to form a PPP, it falls short of elucidating why it chose to form a PPP to execute the ECF project. The scientists interviewed at ILRI identified overlapping synergies and complementary skills and knowledge as the main reason for collaborating with the current partners. In deciding who to invite into the partnership, ILRI identified the skills and expertise needed throughout the various stages of vaccine research and development. This formed the criteria for choosing partners; those that ILRI felt matched the requirements of the R&D process were chosen.

The previous chapter provided a chronological account of the PPP; before the start of the partnership, an ILRI scientist and a TIGR researcher had made an acquaintance. Building on

[18] Van der Meer, K., 'Public-private cooperation in agriculture research: examples from the Netherlands' in Byerlee, D. & Echeverria, R., (eds.) *Agricultural research policy in an era of privatisation* (Oxon: CABI Publishing, 2002)
[19] Buse & Walt (2000) *supra* note 16
[20] Economist, A survey of social insurance: privatising peace of mind, *The Economist* 24 October 349/8029 (1998) at p3

this informal network had as much a part to play in ILRI seeking collaboration with TIGR as did TIGR's obvious technical expertise and experience in genome sequencing. This makes a case for the importance of informal networks especially where they lead to further collaboration.

Merial had vast experience in vaccine formulation, production and commercialisation. It was mainly for these reasons that ILRI was led to collaborate with Merial. Through the partnership, ILRI scientists are able to access not only the private sector partner's technical expertise but also benefit from the proprietary technology brought into the partnership by the private sector. Although Merial had novel technologies relevant to the partnership some of which - like the vaccine delivery platform – were already patented, Merial's *knowledge and expertise* in vaccine R&D was a greater motivation factor than its *technology*. This merits further comment: the ILRI scientists interviewed said that they would have still been drawn to Merial even where the latter had no patented technology. It was Merial's

> 'comparative knowledge and experience in animal vaccine development that attracted us most. Of course it helped that they already had a delivery system which we could use as this saved the partnership time and cost. At first, we were not even aware that they already had a patent on the delivery system, only that it existed.'[21]

Merial had experience and understanding of the development and registration processes for veterinary vaccines as well as considerable manufacturing skills and assets. ILRI saw these in addition to Merial's experience in project management and commercialisation as factors influencing their decision to invite Merial into the partnership.

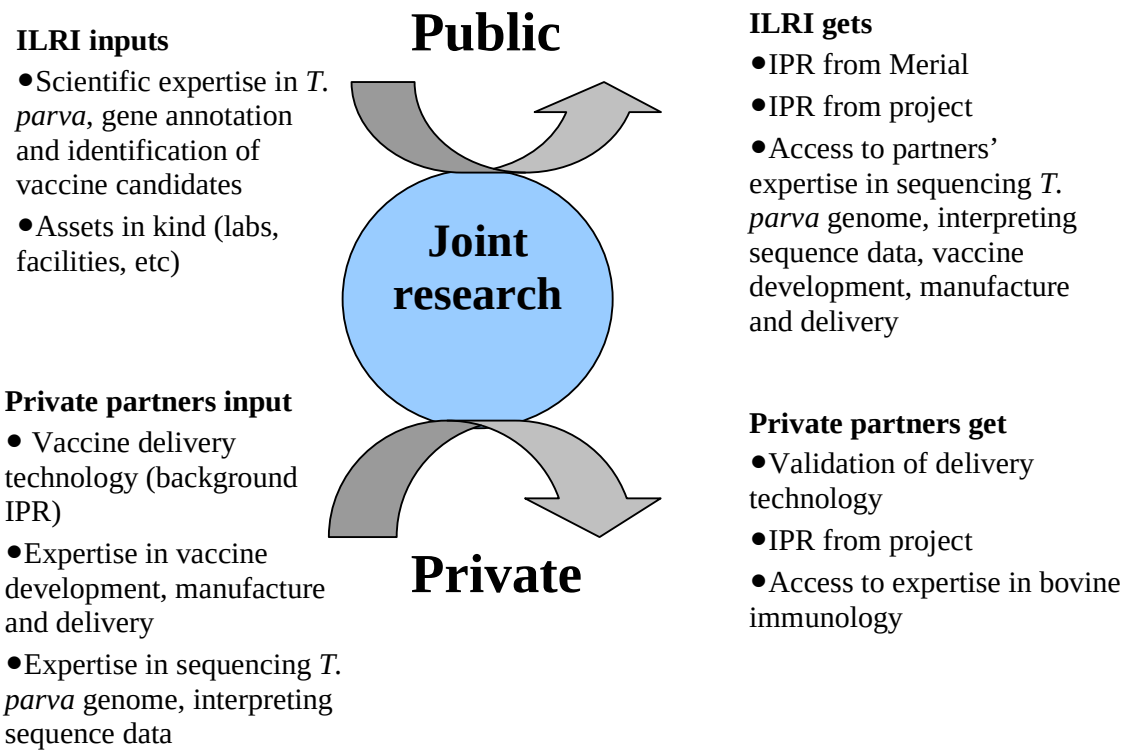
Private sector's perspective

On invitation to join the partnership, Merial responded positively mainly for two reasons: it considered itself as having a long history of involvement in animal diseases in the developing world and would therefore add value to the partnership while increasing its knowledge of the science involved; this was an opportunity to gain access to knowledge held by ILRI and the other partners. Secondly, and most importantly, Merial was attracted to the partnership as the science had great potential to lead to a clearer understanding of how protozoal vaccines of

[21] ILRI, pers. comm.

greater commercial interest may be developed; in other words, the potential spin offs from the research and the concomitant commercial value were of great interest to Merial.[22] Understanding the ECF causing parasite provides insights significant to research into treatment of diseases such as malaria, tuberculosis, HIV/AIDS and some forms of cancer. These were influential factors in motivating Merial and the other partners to collaborate.

Figure 7.4: Trade offs in the ECF project



The representatives interviewed cited the previous connections that Merial had with ILRI as persuasive aspects in their decision to join the project. Merial had previously marketed a sub unit vaccine partly developed by ILRI. Participating in the project allows Merial to build on this relationship. Merial also recognised ILRI's expertise in bovine research. Although Merial had vast experience in animal vaccine research, most of its activities related to pets and horses, participation in the PPP would expose it to the science and knowledge on bovine vaccines. By the time Merial joined the project in November 2001, all the other partners were already members of the PPP, Merial therefore had the advantage of knowing before-hand who the other partners were and their comparative strengths.

[22] Merial, pers. comm.

It was on the basis of TIGR's relationship with ILRI that the PPP was first conceived. TIGR recognised the importance of basic research conducted by ILRI. By participating in the PPP, TIGR gains access to this knowledge while exploiting the synergies existing between and among the project partners.

ICRISAT-PS consortia

Public sector's perspective

In the ICRISAT-PS consortia, ICRISAT sent invitations indiscriminately to private seed companies who bred and/or marketed sorghum, pearl millet or pigeon pea; those who responded favourably and agreed to the terms and conditions joined the consortia.

For ICRISAT, the main motivation for forming the consortia with the private sector was the recognition that the latter had comparative advantage at seed commercialisation. The private seed sector as a whole was perceived as vital in completing the R&D chain. ICRISAT recognised that engaging with the private sector was crucial to the fulfilment of the its food security premised mandate as it did not have the expertise and capacity to distribute its own technologies.

ICRISAT breeders saw the private sector as a vital link with the end users given its close relationship with the farmers. ICRISAT would therefore tap into the knowledge held by the private sector in order to make its research more relevant to farmers and hence improve its mandate. In addition, ICRISAT was attracted to the private sector due to its efficiency in delivering relevant results. It was hoped that ICRISAT would benefit from this organisational and management principle which could be applied in other areas of ICRISAT operations.

Of the three lead scientists interviewed (one for each consortium), only one identified supplementing funding as a motivating factor for engaging the private sector. The rest alluded to this by demonstrating how financially successful the respective consortia were in supporting ICRISAT's core research priorities. The grant funds almost fully covered breeding activities for the three crops. Their view however was the funding was a 'spin off' of the consortia rather than a factor influencing their decision to enter into partnership with the private sector. Finally, ICRISAT was naturally attracted to the private sector given that the

private sector uses more of ICRISAT germplasm than India's public sector does.[23] ICRISAT was therefore building on its existing network with the private sector.

Private sector's perspective

The incentives for the private sector consortia members to join the partnership were many. Firstly, they recognised ICRISAT as a leader in plant breeding in the state of Hyderabad. It is a source of high quality seed. Joining the consortia gave them access to the wide range of ICRISAT improved germplasm and access to ICRISAT's expertise in breeding.

In so far as ICRISAT had done a significant amount of selective breeding and the individual seed companies had access to the germplasm (subject to terms and conditions) whose traits were desired, the seed companies firstly benefited from ICRISAT's technology and secondly, they saved costs in research as the germplasm was already bred for the characteristics they wanted. Even where this was not the case (as in the case of parental lines), costs were still saved as it would take seasons of research and breeding for the private sector to arrive at the lines ICRISAT provided. Obtaining the seed parents was of direct importance particularly to those seed companies with plant breeding programs.

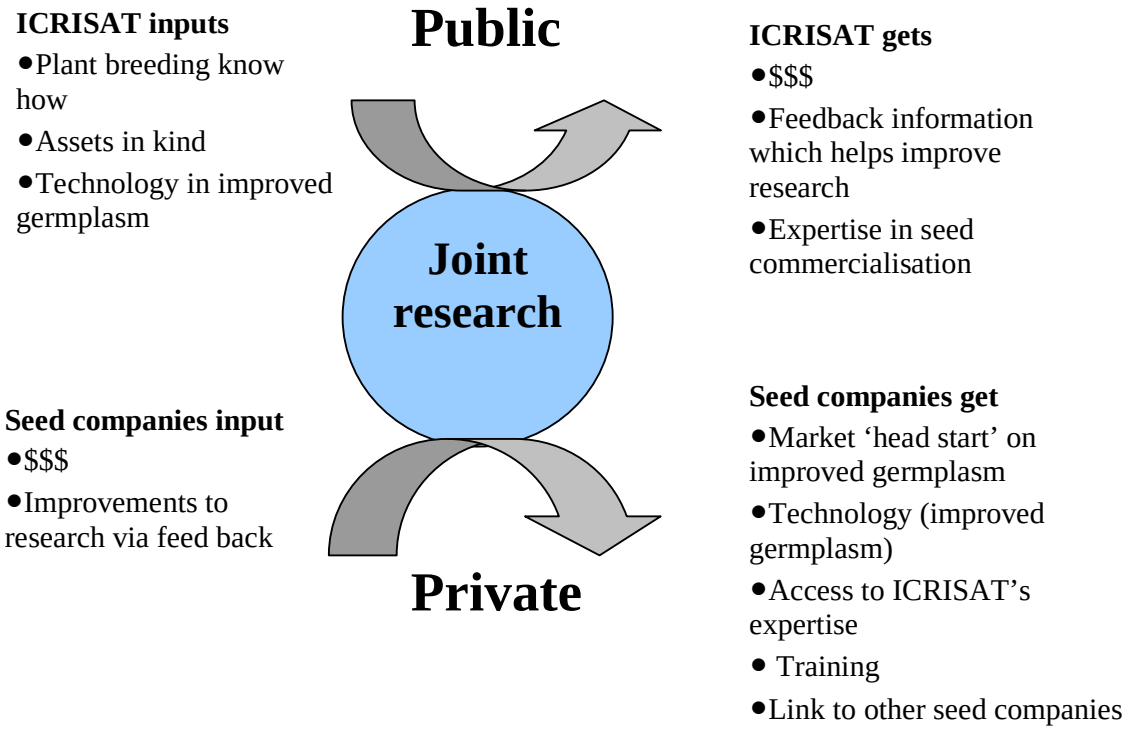
To the extent that the consortia private seed companies have access to ICRISAT improved germplasm before other seed companies who are not part of the consortia, they have a head start which may be crucial in capturing new markets. 24 The consortia private seed companies interviewed cited the favourable terms and conditions (which were sent along with the invitations) as a factor in their decision to join the consortia. The 'head start' condition proved to be a major incentive. Other favourable terms included ICRISAT's undertaking to arrange for staff training through field days, workshops and invitation of the consortia members to relevant conferences. In this way, the private seed companies would benefit from knowledge transfer and increased capacity. This is of more importance to small seed companies with limited training programs.

[23] ICRISAT scientists, pers. comm.

[24] Under the partnership terms of the ICRISAT-PS hybrid parents research consortia, non-members have access to only the first category of improved material (as opposed to members who have full access or partial access depending on membership) and only three years after members are supplied. This gives the consortia members a lead in the market.

The goodwill and trust enjoyed by ICRISAT was cited by all private seed companies interviewed as a main motivating factor for joining the consortia. Previous interaction between individual seed companies and ICRISAT further strengthened this incentive.

Figure 7.5: Trade offs in the ICRISAT-PS Consortia



Information from key informants in the two PPPs suggests that IP had a role in the *creation stage* of the partnerships. This covers a diverse range of IP related considerations such as the design of the PPP, the decision to join the PPP and the choice of partner.

In the case of the consortia, IP was a definite consideration in the design of the PPP. As earlier seen, ICRISAT's MTA prohibits recipients of ICRISAT germplasm from claiming ownership of the material or seeking IPRs over the material. To ensure the germplasm is maintained in the public domain, the MTA is designed in such a way as to allow multiple recipients to receive the same material from ICRISAT. If there were no need to maintain the germplasm in the public domain, ICRISAT would be able to enter into exclusive bilateral contracts with third parties. Aware of this, ICRISAT opted to adopt a model that would allow multiple partners into the partnership without compromising the 'non-exclusivity' nature of

its policy. Referring to the multiple small grants from private seed companies, Reddy *et al.* write:

> "…for IPR reasons the small grants proposal had to be structured and administered as private research grants to ICRISAT, rather than contract research agreements."[25]

With regard to the private sector, some seed companies had IP considerations before they joined the consortia. Indeed, some declined joining the consortia for IPR reasons:

> "After much deliberation and scrutiny of the agreement…Monsanto posed a simple question to ICRISAT, 'If Monsanto [was] to develop further products from material developed under its agreement with ICRISAT, who would have ownership of these subsequent developments? The answer came back from ICRISAT that Monsanto would have ownership of subsequently developed products. Monsanto joined the consortium immediately. However, a few major Indian companies did decline to join the consortium. The reasons differ for each of them. Apprehensions on IPR issues, budget limitations, and their internal strengths/weaknesses are among reasons explaining their reluctance."[26]

The IP considerations at the 'creation stage' in the ICRISAT-PS consortia were significant enough to deter some seed companies from joining the consortia. Monsanto only joined after assurances that it would own subsequently developed material.

In ILRI's case, IP considerations did not feature in the design of the partnership or in influencing the choice of partners to involve. ILRI's utmost concern at the time was choosing partners with the right experience, knowledge and skills who appreciated and shared the project's goal. ILRI's choice of partners was influenced by the potential partner's comparative advantage and research knowledge and competence. In so far as these contribute to intellectual assets, it may be argued that ILRI's considerations stopped at the intellectual assets necessary for the execution of the project; whether or not these intellectual assets were protected (and hence intellectual property) did not matter to ILRI.[27]

[25] Reddy, B., Hall, A. & Rai, K., The long road to partnership: private support of public research on sorghum and pearl millet, in Hall, *et al.* (2001) *supra* note 2 at p30
[26] Id at p31
[27] ILRI, pers. comm.

Typically, the private sector will carefully look at the IP involved in the project and the IP clauses in the partnership agreement. It will then assess the risk versus the benefits for joining the partnership. In the ECF project, Merial joined the partnership after all the initial partners had joined. It was thus aware of all the IP involved in the partnership and the IP related clauses in the agreement. Interestingly, the ILRI-DfID funding agreement requires the partnership to grant DfID through the University of Edinburgh, a non-exclusive licence of the end product; DfID is to retain the sublicence and can grant it to any party (even those outside the partnership) to supply the end product. This was done as a safety measure to ensure that the end product would be delivered to the end users. [28]

To the extent that Merial was aware of this when joining the partnership, it can be argued that IP was a consideration in joining the partnership but not significant enough to deter Merial's membership. The project's membership however harbours concerns that the DfID IP clause may deter potential partners from joining the project.[29] As at December 2006, there were no plans to expand the membership; it is therefore not possible to assess the effect of the DfID clause in this regard.

7.3.2 IP in stage 2: negotiation of partnership arrangement

7.3.2.1 IP policies

The public sector

The parties' differing perspectives on IP are reflected in their respective IP policy documents. Chapter six examined ILRI's and ICRISAT's IP policies in detail. ILRI's was found to be flexible enough to allow for IP protection as and when the need arises. There is nothing in the policy to suggest that ILRI is averse to patenting or prefers one mode of IP protection over another. With regard to covering IPRs on jointly developed products, ILRI's policy seems to recognise that there may be a need for ILRI to protect research results although it does not go into details of ownership; this is left for the parties to negotiate and to be expressed in subsequent agreements.

ICRISAT's policy on the other hand clearly states that 'as its basic policy, ICRISAT pursues *publication and full disclosure and the open sharing* of ICRISAT data, information and

[28] Id
[29] Id

knowledge through the release of ICRISAT research findings and products into the public domain.' This clearly demonstrates that ICRISAT's first port of call in IP protection is publication. It is presumed that this is publication of scientific criteria as well as defensive (enabling) publication.

ICRISAT's policy refers to joint ownership of research products and provides that 'where collaborative research products are to be owned jointly, ownership and/or use of the product will be negotiated by the partners. Securing such research products in the public domain will be a priority for ICRISAT in such collaborative work.'

ICRISAT signed a Memorandum of Agreement with the European Patent Office (EPO) enabling the former to disseminate its research products in the latter's Non-Patent Literature (NPL); by doing so, ICRISAT places its IP in the public domain where it acquires the status of prior art. Efforts are underway to identify internal publications such as technical reports, annual reports and monographs in order to add them to the EPO's NPL database.

The private sector

Virtually all the consortia Indian seed companies interviewed did not have IP policies. Most were concerned with seed certification requirements. The private seed companies mostly deal in hybrid crop varieties. By their nature, hybrids cannot be protected by PBRs as they do not meet the universal stability requirement. In this regard, the seed companies have no exposure in obtaining PBRs. In any case, India's PVP law is yet to be implemented and therefore, none of the seed companies have applied for PBRs even for other crops that meet the NDUS criteria. Two companies however expressed the desire to formulate an IP policy to guide their plant breeding efforts in the future.

The private sector partners in the ECF project have extensive IP policies. Merial is a leading company in animal vaccine research and has already patented some of its technology including the delivery system used in the project. Typically, Merial's policy objective is to protect inventions by patents and other instruments normally in use in the private sector e.g. trade secrets and confidentiality agreements.

7.3.2.2 Governing documents and their negotiation

The ECF project is governed by a master partnership agreement: the collaborative research agreement. In addition to this, MTAs are used for transfer of material from one partner to another. Confidentiality agreements are also used. The ICRISAT-PS consortia are governed by the respective Letters of Agreement. Just like the ECF project, MTAs are used to transfer material from ICRISAT to the consortia members; the FAO MTA is used for designated germplasm while the standard MTA is used for non designated germplasm. Confidentiality agreements are also used.

The preparation leading to the main governing documents in the two PPPs differ greatly. Although ICRISAT sought the input of potential consortia members through three rounds of discussions, the drafting of the guidelines and the partnership agreements was ICRISAT-led. The Governing Board in 2003 approved the revised guidelines for the consortia. Letters inviting the private sector to join the consortia were subsequently sent to seed companies. ICRISAT received feedback on the guidelines from some seed companies which formed the basis for subsequent amendment of the guidelines and Letters of Agreement; these were sent to those seed companies who had confirmed their willingness to join the consortia. Once the consortia were up and running, seed companies wishing to join the consortia sign up to it on a 'take it or leave it' basis. They are not free to negotiate the terms on the standard form.

The experience with ILRI was very different. All parties were involved in negotiating the terms of the agreement. Although ideal, this model of consensus building has its drawbacks. The scientists interviewed decried the costs of this in terms of time and administration. Should other organisations or companies wish to join the partnership, past experience suggests that all parties would be involved in re-negotiating the terms on the master agreement.

The involvement of parties in formulating the partnership agreement has a direct bearing on their perception of its terms. Asked what would take precedence if there was a conflict between a party's IP policy and the terms and conditions of the partnership, ICRISAT responded that its policy would override the partnership agreement although it was unlikely that such a situation would occur. Any potential conflict would be resolved on a 'case by case basis.'

Table 7.2: Respective parties' differing perspectives on IP

Perspectives	ECF vaccine project		ICRISAT-PS consortia	
	ILRI	Private sector	ICRISAT	Private sector
(a) Is there an IP policy?	Yes	Yes	Yes	No*
(b) IP policy objective	Flexible enough to cover patenting	Seek appropriation through patenting, trade secrets	Publication and full disclosure	Not applicable*
(c) IP instruments used in the PPP	collaborative research agreement, MTAs, confidentiality agreements		Letters of Agreement, MTA, confidentiality agreements	
(d) How were IP instruments negotiated?	Joint negotiation among all parties#		Standard form Letters of Agreement drafted by ICRISAT incorporating feed back from private sector#	
(e) Should there be a conflict between (a) and (c), what takes precedence?	Policy flexible enough to allow for incorporation of IP terms; negotiate	negotiate	IP policy takes precedence	Not applicable as IP policy not existing*

*Although the MNCs had IP policies, all local consortia seed companies interviewed did not have IP policies, #the MTAs in use are CG standardised and are similar across all CG Centres; partners dealing with CG Centres have no input in MTAs' provisions

ILRI's response was that because the project partners have different IP policies, the partnership agreement tries to reflect this in its terms on IP. As ILRI's policy is flexible enough to address the issues in the partnership agreement, the incidences for conflict between the two are minimal. Any potential conflict is to be resolved by negotiation among the project partners.

7.3.3 IP in stage 3: execution of the partnership

7.3.3.1 Role of national IP legislation in the PPPs

All parties interviewed were aware of the existence of the respective host countries' IP legislation. As the nature of the research dictates the type of intellectual property applicable, partners in the consortia were aware of the provisions of India's Protection of Plant Varieties and Farmers' Rights Act but not of the provisions in India's Patent Act. The partners in the ECF project were similarly more familiar with the provisions in Kenya's Industrial Property Act rather than the Seeds and Plant Varieties Act.

When asked about the influence of the relevant domestic IP legislation on the PPPs, all parties were of the opinion that the respective legislations had minimal to no influence on the PPP's activities. ICRISAT's IP policy states that

> "ICRISAT will strive to comply with national laws that are relevant for the use of protected intellectual property in all locations where it operates. In this regard, ICRISAT recognises that international trade has significant implications on the use of intellectual property, particularly in protected market jurisdictions. ICRISAT will inform and educate … its beneficiaries and partners on these issues."

By extension of its policy to the partnership agreements, ICRISAT infers that the consortia will 'strive to comply' with Indian PVP law. Under the Protection of Plant Varieties and Farmers' Rights Act, a PVP applicant has to provide the background information pertaining to the variety under application. This is however not relevant in the case of the consortia: The MTA for transfer of ICRISAT bred material prohibits recipients from claiming ownership or seeking IP over material received, 'or its genetic parts or components in the form received.' The recipient is also bound by the provision not to seek IP over information related to the material received. A note to the clause states that

> "This does not prevent the recipient from releasing the material (or its products) to farmers for cultivation… Materials released should be acknowledged and ICRISAT should be informed of the details."

In the host countries, IP legislation provides the framework for protection of intellectual property. The legislation's utility to an innovation partnership is demonstrated inter alia through firstly, facilitating registration of research products; secondly, addressing enforcement of IP and thirdly, for settling disputes.

The ECF partnership agreement addresses the protection of IP as do ILRI's and ICRISAT's policies. To the extent that the institutions envisage securing IP protection as necessary to further their mandates in certain cases, the national IP framework is crucial in ensuring this. In the case of the consortia, India's IP Act and PVP Act are of no consequence to the partnership as seeking IP protection is prohibited.

The ECF vaccine project involves two delivery systems which are protected by patents. These are owned by Merial and the University of Oxford. The candidate sequences are also patented and are jointly owned by the project partners. The PPP has produced candidate antigens formulated using the delivery systems. These have formed the basis of two patent applications filed through the PCT designating 11 African countries of which Kenya is one. To this extent, Kenyan IP system is relevant to the partnership.

With regard to enforcement and dispute settlement, neither PPP have use for the national IP framework. Under the ECF project, partners are expected to honour the terms and conditions set out in the agreements. There has not been a situation to date where a matter has had to be referred to the courts. Even if this were to occur, it would probably be brought before the commercial courts rather than the Tribunal established under the Industrial Property Act. The partnership agreement provides for arbitration. This provision has not been invoked to date.

The ICRISAT-PS consortia are likewise self-enforcing. The PPP is based on goodwill between ICRISAT and the respective members. The Letters of Agreement provide for dispute settlement by mutual discussion between the parties. Should this fail, or where there is any other dispute regarding interpretation and implementation of the agreement, 'any controversy, claim or dispute … concerning questions of fact or law, or breach thereof, will be settled or determined by the Management of ICRISAT, which shall be binding and final.' As at December 2006, there were four instances of breach: one relating to the pearl millet consortium, two in the sorghum consortium and one in the pigeon pea consortium. These were dealt with using the dispute settlement provisions in the respective agreements. These provisions dispense with the need to seek redress through not only the mechanism provided under IP law but also that under the entire Indian legal system.

From the foregoing, it is evident that domestic IP law plays a minimal role in the two PPPs. The bulk of the PPPs' activities are rather determined by the agreements between and among the partners. Contract law is therefore more relevant than IP law. This underscores the findings in previous chapters which advocate for capacity building in IP contract negotiation and execution.

7.3.3.2 Value placed on IP

In their analysis of factors necessary for developing effective and sustainable partnerships, Saad *et al.*[30] identify at least seven factors: availability of resources, prior relationship between organisations, trust, complementary skills between partners, communication, mutual understanding or partners' needs and objectives and the equality of partners.

As the focus of their analysis was neither on development related PPPs nor technology based PPPs, their results are cited with caution. IP did not feature in their identification of the vital factors. Nevertheless, their study is instructive in demonstrating the general important factors in a PPP.

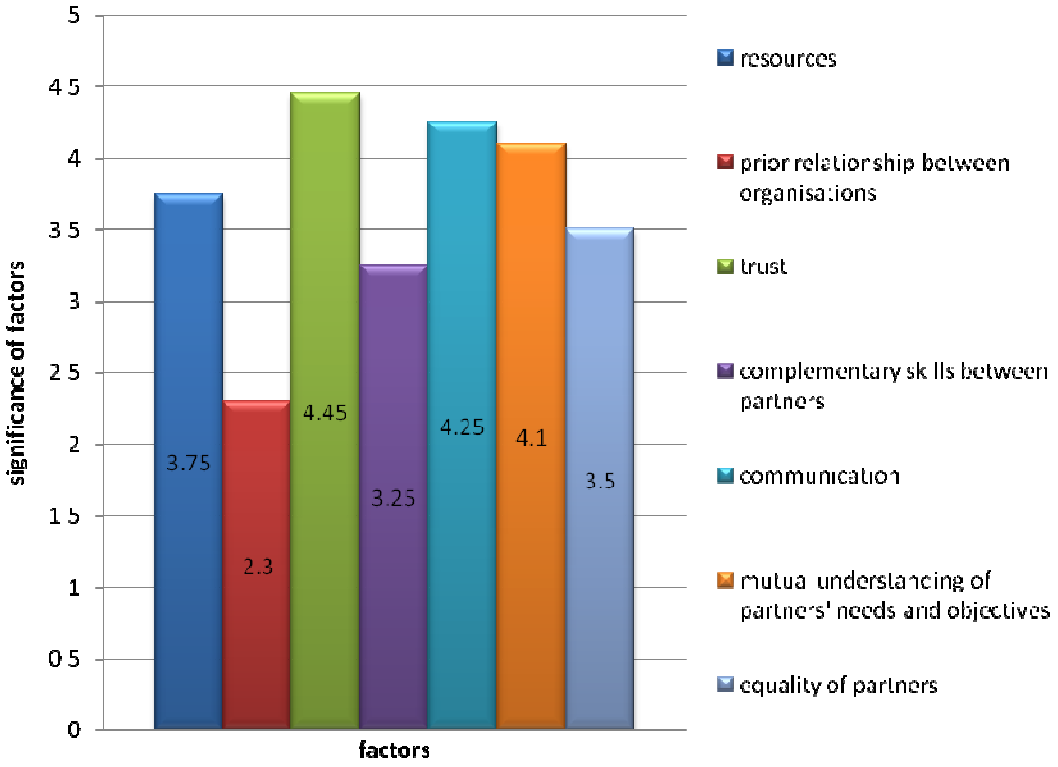
Saad *et al.* see trust as central to partnerships; communication between the parties is a close second while mutual understanding of partners' needs and objectives and the availability of resources are also important. Of the seven factors, prior relationship between organisations is ranked last and surprisingly, complementary skills between partners is ranked sixth. Equality of partners is ranked higher than complementary skills; perhaps like Brinkerhoff,[31] Saad *et al.* opine that power imbalance inhibits the mutuality required for a partnership to work.

In his analysis of partnerships between the public and not for profit private sector, Lovrich argues that social capital is central to PPPs. In so far as mutual and social trust are integral to social capital, these are vital to PPPs. The concept of social trust, as created by James Coleman holds that

> "Like other forms of capital, social capital is productive, making possible the achievement of certain ends that would not be attainable in its absence… for example, a group whose members manifest trustworthiness and place extensive trust in one another will be able to accomplish much more than a comparable group lacking that trustworthiness and trust."[32]

[30] Saad, M., Rowe, K. & James, P., 'Developing and sustaining effective partnerships through a high level of trust' in Montanheiro, L., *et al.* (eds.) *Public and private sector partnerships: furthering development* (Sheffield: SHU Press, 1999)
[31] Brinkerhoff, D. & Brinkerhoff, M., Partnerships between international donors and non-governmental development organisations: opportunities and constraints, *International Review of Administrative Sciences* 70/2 (2004) 253
[32] Coleman, J., *Foundations of social theory* (Cambridge: Harvard University Press, 1990) at p304

Figure 7.6: Important factors in execution of PPPs



Source: Saad et al. (1999) with modifications

Putnam[33] and Fukuyama,[34] argue that social capital is built on trust, norms and networks and serves to facilitate collective action. Interpersonal trust lies at the core of social capital. Bezanson *et al.* report on an independent evaluation of the partnership committees in the CGIAR.[35]

In considering the characteristics of PPPs sought by the CGIAR, the authors observe that the 'intensity of requirements for a successful partnership varies with the purpose and type of partnership being sought.' They develop a rough typology based on the depth and intensity of arrangements required for five different types of CGIAR partnerships: consultative, coordinative, complementary, collaborative and critical partnerships.

To Bezanson *et al.*, openness and participation of parties are common attributes in the five categories of partnerships. As the intensity of partnership arrangements increases, other

[33] Putnam, R., Bowling alone: America's declining social capital, *Journal of Democracy* 6 (1995) 65
[34] Fukuyama, F., *Trust: the social virtues and the creation of prosperity* (New York: Simon & Schuster, 1995)
[35] Bezanson, K., Narain, S. & Prante, G., *Independent evaluation of the partnership committees of the CGIAR : Final report* (Washington DC.: CGIAR, 2004)

factors are added to the two basic requirements. Mutual trust is common to complementary, collaborative and critical partnerships. Under this schema, one would expect the ECF to contain more key elements than the ICRISAT consortia as the former is a more 'intense partnership' than the latter.

Table 7.3: Types of CGIAR partnerships and their key requirements

Nature of partnership	Description	Objective	Possible areas for partnership	Key requirements
Consultative partnership	Sharing of knowledge, information, technologies through agreement on lines/forms of communication	Information exchange; Awareness building	Seminars, workshops, consultations, newsletters, electronic connectivity	Openness; Participatory
Coordinative partnership	Separate initiatives not necessarily supportive of each other yet aspiring to complementarity to achieve efficiency and effectiveness	Avoidance of duplication; Synchronisation of activities	Awareness Campaigns; *Ad hoc* committees on country, sectoral or scientific concerns	Openness, Regular and sustained efforts; Representative arrangements
Complementary partnership	Separate initiatives but guided by a common framework characterised by purposive efforts to support each other	Integrated program approaches; Resource sharing	Public-private MOUs on technology production and distribution	Mutual trust; Established complementarity of interests; Leadership support; Participatory
Collaborative partnership	Joint efforts with a common vision and objectives	Joint programmes; Policymaking	Long-term joint programmes; Institutionalised mechanisms	Mutual trust; Shared vision; Congruence in strategy; Leadership; Participatory; Clear delineation of tasks/ responsibilities
Critical partnership	Interdependence; Recognition of each other as indispensable partners in the development process	Joint strategic planning; shared decision making & implementation	Long-term and Institutionalised working relations	All of the above plus:-longer-term, codified 'voting' or decision making regime

Source: Bezanson et al. (2004), with modifications

In their analysis of constraints in international agricultural research PPPs, Spielman & Grebmer hypothesise that formation of PPPs is limited by five factors: parties' fundamentally different incentive structures, insufficient minimisation of the costs and risks of collaboration, an inability to overcome mutually negative perceptions, limited use of creative organisational mechanisms to reduce competition and insufficient access to information on successful

partnership models.[36] By inference, these five constraints point to the important factors in a successful PPP. In so far as incentive structures constitute IP and related arrangements, IP is potentially an important factor in the execution of a PPP.

A recent study on 75 PPPs in the CGIAR showed that 51 percent of all the partnerships involve the use or exchange of proprietary knowledge. This suggests that IP is an important issue in considering the design and implementation of PPPs.[37]

ILRI opine that IP's role was more significant after the formation of a PPP rather than before its creation. But even then, other factors are more vital to the success of the PPP. Different informants from ILRI cited various factors as being more important than IP. First of these was mutual trust. Others included transparency, confidentiality, good-will and mutual understanding of expectations. IP was seen as a tool to help in achieving the project objective rather than an end in itself.

> 'IP is important, but not the most important. It is a tool. The decision [to enter into] a project, to jointly own, to publish, to commercialise… should be informed by the goal or objective of the research, not the presence of IP.'[38]

This view was echoed by the private sector partner who listed factors such as realistic expectations, quality of the team, technical input and expertise as more important than IP. Merial however stated that while IP does not make a partnership successful, it may in some cases be significant in determining the course of the PPP; it has in the past, fallen out of partnership due to IP reasons.[39] Merial applied for protection of new technology developed under the ECF project. It bore the costs of drafting and of the application; the project collaborators were named as inventors.

None of the parties interviewed in the ICRISAT-PS consortia cited IP as even marginally important to the implementation of the project. Summarised, the most important factors to the consortia according to key informants are mutual trust, good-will, confidentiality, efficiency and mutual benefit. One informant from ICRISAT mentioned IP but stated that IP was not

[36] Spielman, D. & Grebmer, K., Public-private partnerships in international agricultural research: an analysis of constraints, *Journal of Technology Transfer* 31 (2006) 291
[37] Spielman, Hartwich & Grebmer (2007) *supra* note 1
[38] ILRI, pers. comm.
[39] Merial, pers. comm.

vital to the implementation of the consortia. This would appear to be the case given the unambiguous provisions relating to ownership of designated and ICRISAT improved germplasm. This indicates that the nature of research influences the role that IP plays in a partnership. Reddy *et al.* argue that 'it is the resources and skills of the company rather than an exclusive IPR agreement that… gives a competitive edge over other private seed companies.'[40] In other words, it is the company's research capability and its ability to use material from the consortia to make and market hybrids that are most in demand that enable it to have an advantage over the market. An exclusive IPR agreement on its own would not guarantee this.

7.4 IP related issues and challenges

IP in the context of public agricultural research has been the subject of much comment in the last decade. The significance of IPRs to public agricultural research was catalysed by various factors. These include the increasing protection of technology in agricultural biotechnology especially by the private sector; public research institutes are currently more likely to be dealing with technology protected by third parties than ever before so that research depends on securing permission to use third parties' IPRs. Secondly, to maintain research products in the public domain as per their mandate, public research institutes are more aware of the IP measures needed to avoid appropriation of their technology by third parties. Thirdly, collaboration with the private sector may expose public research institutes to IP issues especially if the subject of collaboration requires or yields proprietary technology. This is more likely to occur in agricultural biotechnology.

If issues related to IP and its management generally present a challenge to public agricultural research institutes including IARCs, IP issues in the context of PPPs further compound these challenges. IP issues specific to PPPs relate mainly to two concerns: one, IP capacity and two, IP management. The examination below assumes that the first is more lacking in the public sector partners of a PPP than their private sector counterparts. IP management is needed in all parties and in the project itself. As mentioned earlier, the nature of research conducted in a PPP determines or at least influences the role that IP plays in the partnership. To this end, the ECF project is more exposed to IP issues than the ICRISAT-PS consortia are.

[40] Reddy *et al.* (2001) *supra* note 25 at p31

With regard to IP capacity generally, the CGIAR Panel on Proprietary Science and Technology reviewed the CG's guiding principles on IP in 1998 and highlighted the need for strengthening CG Centres' capacity in IP management.[41] This led to the establishment of the Central Advisory Service for Intellectual Proprietary to assist all CG Centres on IP matters. Some CG Centres have IP management units, a few undertake IP audits but none have technology transfer offices.

ILRI and ICRISAT each have a full time IP manager; in addition to this, ILRI outsources a local IP attorney and one based abroad; both are on a retainer. The CGIAR Central Advisory Service on IP assists both centres on IP matters as it does all CG Centres. ILRI has considerable experience in dealing with IP issues in a PPP context having had at least 5 PPPs all of which involve IP to various extents. However, IP issues were still identified as a challenge in the ECF project given its unique design and the IP conditions in the funding agreement.

At the start of the ECF project, background and future IP and other IP issues were not negotiated; ILRI was of the view that IP should be negotiated on knowledge of the nature of the final product. This perspective clashed with that of its private sector partner which preferred to make concrete definitions relating to roles and ownership of IP at the onset. These differing perspectives present a challenge to IP management. Moreover, the ECF project has potential IP challenges given its unique staggered membership design; it is not clear how parties who have left the partnership e.g. DfID would share in the IP should negotiations be conducted when the end product is produced.

Capacity in IP issues including IP negotiation is vital in PPPs that involve proprietary technology. In their review of four PPPs in health R&D for diseases of poverty, Kettler and Towse contend that in proprietary PPPs, the most important strategic tool is the partnership research contract particularly the conditions on IP.

> "Critical negotiation is needed on the ownership of both background IP and IP created with PPP resources. PPPs must be as aggressive in the way they use IP as any commercial unit but for a different purpose – namely to pursue their social objective…This involves the negotiation of creative IP arrangements that do not

[41] TAC., Report of the CGIAR Panel on Proprietary Science and Technology, Document No. SDR/TA:IAR/98/7 (1998)

> scare off companies but also allow the PPP enough control to ensure their ultimate objective, a difficult challenge."[42]

This view is in part shared by Spielman *et al.* who argue that IPR exchanges between partners in a PPP are a function of the CG Centre's ability to successfully negotiate with the private sector. They posit that the 'centres' requests for proprietary assets are often marginalised by the private sector' which is partly due to centres' lack of capacity in identifying and evaluating their own proprietary assets and thereby negotiating more successfully with the private sector.[43]

A centre's lack of an IP management system may inhibit its ability to access information on a partner's proprietary assets as well as those held by its partner's competitors.[44] In other cases, IP clauses may have the same effect. In the ECF project, the agreement between ILRI and Merial prohibits the former from obtaining information from the latter's competitors.

Generally, management of IP invariably increases the costs of research. This is regardless of whether a centre chooses to outsource or to manage IP in house. In a PPP, confidentiality agreements may increase the coordination costs generally and the cost of IP management specifically. In the agreement between ILRI and Merial, the former can only contact other firms conducting vaccine research after prior discussion with the latter.

> "Given that the animal health sector comprises far more players than the crop-science sector, the agreement terms generate prohibitively high search costs for ILRI to identify new research partners with potentially useful technologies."[45]

Conditions such as this and the inhibition to obtain information from Merial's competitors may lead public research institutes to reconsider the stage at which to involve the private sector. Some informants at ILRI were of the opinion that involving Merial after the proof of concept stage would have been desirable in terms of saving the project's coordination costs.

From the private sector perspective, companies may fear that entering into a PPP that combines its IP with that of the company's background IP may limit the company's ability to

[42] Kettler & Towse (2002) *supra* note 15 at p67
[43] Spielman, Hartwich & Grebmer (2007) *supra* note 1
[44] Id
[45] Id at p42

use its background IP for other uses especially if early tests fail.[46] Although this is a risk generally taken by private companies in their collaborative ventures with other companies, the IP challenges in a PPP are perceived to be somewhat different and more risky. Private sector partners' insistence on confidentiality clauses in spite of their impact on coordination costs is borne out of the fear that the PPP will transfer the knowledge learnt in the PPP to parties outside the partnership. 'If the PPP knows it, everyone else will.'[47] To the private sector, the potential 'damage' this may cause is worth the coordination costs. This again illustrates the difference in perspectives on the utility of knowledge: the public sector typically does not view knowledge or information shared in 'potential damage' terms, if anything it aims at putting knowledge in the public domain. This underscores the need for mutual trust.

A PPP's design may have IP implications. Although ICRISAT is committed to facilitating access of its research products to the public, the design of the PPP including the terms of the Letters of Agreement in the ICRISAT-PS consortia in effect offer limited exclusivity to firstly primary consortia members and secondly, promotional consortia members. The consortia allow access of the former to all categories of material (see table 6.6 in chapter six) three years before the latter who have access to *some* categories of the material three years before the public. To this extent therefore, the consortia can be said to offer some exclusivity. Further, it has been argued that the consortia membership fees are an entry barrier for smaller seed companies.[48]

7.5 Conclusion

It is submitted that IP has a role to play in food security oriented PPPs; it has the potential to either support or constrain a partnership's objectives. Its significance, as demonstrated by the case studies in the discussion above, is determined by two factors: the nature of the technology used in the partnership and the stage of the partnership. Projects involving proprietary technology are more likely to find IP more significant than those whose research products have no potential proprietary value. This however varies according to the stage of

[46] Kettler & Towse (2002) *supra* note 15
[47] Id quoting an informant from the private sector
[48] Spielman, Hartwich & Grebmer (2007) *supra* note 1

the partnership. Taken together, the two determinants (nature of technology and stage of partnership) suggest the following:

(a) for PPPs whose research is potentially proprietary (e.g. ECF project), IP is mostly significant at the negotiation and execution stages and less so at the PPP creation stage;

(b) for PPPs with non-proprietary research products (e.g. ICRISAT-PS consortia), IP is mostly significant at the formation stage and hardly plays a role in the negotiation and execution of the partnership.

In the case of both determinants, the case studies further suggest that other factors such as mutual trust, communication and research competence are crucial.

Parties' attitudes to IP are influenced by their respective IP policies and their institutional and research cultures. ILRI and its private sector partners in the ECF project have institutional policies on IP. On the other hand, most of the local seed companies in the ICRISAT-PS consortia do not have IP policies. The PPPs demonstrate a willingness to address the differences between the respective sectors and to learn from each other. This is particularly true of the ECF vaccine project although this has little impact on strengthening ILRI's IP capacity.

The IP policy objectives differ across the institutions identified as having IP policies. By the end of the data collection period, there had not been any conflict between any of the parties' policies and the agreements governing the respective PPPs. Findings suggest that if a conflict was to occur, the various parties would handle it differently; negotiation would be used in the ECF project while ICRISAT's IP policy would take precedence in the consortia.

The negotiation of the agreements governing IP in the respective PPPs studied was conducted differently. The consortia's standard form agreement is easy to administer; conversely, the ECF project agreement requires negotiation by all partners. While commendable for its democratic inclusion, the downside of the ECF model is that it increases the costs of IP management and of the partnership.

Domestic IP law *per se* has had minimal impact on the formation, negotiation and execution of the PPPs: the parties' IP policies (as well as the documents governing the respective PPPs) have had no input from national legislation whose only utility is to provide the framework under which proprietary technology, as was demonstrated in the ECF project is protected.

The enforcement and the dispute settlement function of the IP system in both host countries have not been and are unlikely to be invoked by the respective PPPs.

Chapter Eight

Summary and conclusions

8.0 Introduction

Chapters two to five addressed at least four research questions. To recap, these are as follows: (i) What effect have IPRs had on private sector presence in agriculture in Kenya and India? (ii) What is the effect of IPRs on the provision of public goods? (iii) How can IPRs be used in the provision of public goods in order to mitigate the theoretical tension between private rights and public goods? (iv) How does national domestic IP legislation affect the conduct of research in agriculture PPPs in Kenya and India?

Chapter one introduced the problem: that agriculture research and the attainment of food security is constrained by the tension between public sector research that is often not applied and private sector research that is applied but primarily for commercial purposes. It highlighted the increase in use of IPRs in food security oriented research and introduced PPPs as institutional mechanisms that attempt to resolve the tension in agriculture research through the exploitation of existing synergies between the two sectors.

Chapter two explored the trends and developments in agricultural R&D in Kenya and India. The main query was the effect that growing privatisation has had on food security in developing countries. The chapter provided evidence of increasing privatisation in Kenya and India; it examined the link between IPRs and increased private sector presence in agriculture and asked whether IPRs have influenced the changes witnessed in agricultural research in the development context.

Chapter three theoretically considered the effect of IPRs on the provision of public goods. The main question addressed was whether the use of IPRs to protect products developed by public research institutions - particularly IARCs - conflicts with the IARCs' mandates to provide public goods. It distinguished between the *existence* and *exercise* of IPRs. The chapter introduced the CGIAR as the largest public investor in agricultural research in

developing countries. Chapter three also looked at the *potential* impact of IPRs on food security.

Chapter four asked whether IARCs, other public research institutions and PPPs can use IPRs in ways that facilitate the fulfilment of social welfare objectives such as contributing to the attainment of food security. It investigated the current practices in place and explored the role of IP related policies in the creative exercise of IPRs to balance competing interests.

The main issue confronted in chapter five was whether domestic IP law has any effect on the conduct of research in agricultural PPPs, or indeed generally. The chapter analysed IP legislation in Kenya and India relevant to agricultural research. The enquiry was part of the larger issue of the impact of IPRs on domestic innovation.

The case studies were reviewed in chapter six while chapter seven consisted of their analysis. The chapters assumed that the public and private sectors have different perspectives on the concept and application of IP. They assessed whether and how the differing perspectives on IP influence the partnerships. The chapters also investigated the value the respective partners placed on intellectual property in the context of the two case studies. The aim of this was to map the significance and role of intellectual property on the respective partnerships.

This final chapter consists of a recap of the main research questions in the preceding chapters. It juxtaposes the research questions with the experiences and findings from the two case studies. The aim of this task is two fold: firstly, to close any gaps between the theoretical aspects of the research questions and the practical experience provided by the two PPPs. Secondly, it exposes the discrepancies between what is assumed following a theoretical analysis of the research questions and the evidence apparent from the case studies.

The ultimate objective of this exercise is to highlight issues for further research and action. A summary of the overall findings is provided, followed by an attempt at suggestions as to the way forward.

8.1 The role of IP in the changing agricultural R&D environment

Setting the scene for the thesis, chapter two explored the trends and developments in agricultural research in Kenya and India. It traced the developments in agricultural research in the two countries. The aim of this was to firstly lay the foundation for the thesis by an exposition of the agricultural research environment in the two countries and, secondly, to investigate the changes that have occurred in agricultural research in both countries and their impact on the attainment of food security.

The chapter found that although agricultural research is still predominantly funded by the public sector in India and Kenya there is increasing private sector presence in both countries. Investment from the private sector is growing at a faster rate than that from the public sector; the number of private sector companies engaging in agriculture is also on the increase in both countries. There are also indications of increasing collaborations between the public and private sectors.

The private sector was found to be drawn to the agricultural sector by a variety of factors. The removal of barriers to private sector participation generally in India though the implementation of the seed policy in the 1980s was a main factor influencing growth of the private sector. Other factors include the appropriation of research benefits, the size of the potential market for new products, the cost of developing new technology and the role played by the public sector.

The possible link between IPRs and private sector presence in agriculture was examined on two levels: firstly, whether IPRs have helped increase the private sector's presence in agriculture in developing countries and secondly, whether an increase in private sector presence in agriculture has popularised IPRs. On the first account, IPRs as an incentive to the private sector in developing country agriculture was found to be tenuous. There is evidence that the private sector applies strategies other than IPRs for appropriation of benefits from agricultural research (such as hybridisation in plant breeding instead of seeking PBRs). This is however not to say that they consider IPRs unimportant. On the second account, private sector engagement in agriculture was found to increase the likelihood of using IPRs; agricultural public research institutions in part attribute their exposure to IPRs to increasing engagement with the private sector.

8.2 IPRs and the provision of public goods

Chapter three considered the effect of IPRs on the provision of public goods and whether this compromises the mandates of IARCs. Being non-rivalrous and non-excludable, public goods are unsuitable for private entrepreneurship due to the wide dispersion of benefits whereas the rivalrous and excludable nature of private goods renders them suitable for private provision.

Using the classical Samuelson-Musgrave criteria for public and private goods, the chapter found that most goods move along the public good-private good continuum. There are hardly any examples of pure public goods; agricultural research does not produce pure public goods but rather impure public goods as some users can be excluded or charged for some uses of the goods produced. The products of agricultural research contain both public and private goods characteristics and are therefore 'mixed goods'. The interests of both the public and the private sectors converge on these types of goods making them good candidates for PPPs. In theory, the application of IPRs on hybrid or impure public goods introduces excludability but not rivalry. IPRs may help improve the use of scarce resources when applied to rival goods. However, their application to vital welfare goods such as drugs and food crops may lead to under-consumption with dire consequences for food security for example.

IPRs impact on the provision and utilization of mixed goods in two ways: firstly, where the provision of the good had public characteristics in that it was equally available and accessible to all, IPRs restricts the accessibility element: the good protected is still available but only accessible on payment of royalties. Secondly, where utilization of a public good had private good characteristics such that one person's consumption reduces the amount available for others (as is the case even with most ready examples of impure public goods such as the justice system, education and health), IPRs render the utilization of the good non-rivalrous so that one person's consumption does not subtract from others' consumption.

The overriding objective of public agricultural research particularly that of IARCs, is to provide global public goods accessible to all - especially the poor in developing countries. Theoretically, in so far as IPRs introduce excludability when applied to goods, the use of IPRs is at odds with global agricultural research. This presents a major challenge to IARCs who increasingly find they have to deal with or apply IPRs in their research. Situations where this may occur include but are not limited to: protection of research products to restrain

appropriation by third parties; protection of products to facilitate access to farmers; protection where it is deemed necessary to ensure collaboration with the private sector in order to fulfil mandate and, though unlikely, protection of research products for income generation.

The challenge to IARCs therefore is how to apply IPRs where needs dictate without compromising their mandate to provide global public goods. In effect, the question is one of applying IPRs whilst mitigating its 'excludability' element. Chapter three argued that there is a distinction between the *existence* and the *exercise* of IPRs and that it is the latter rather than the former that influences the delivery of public goods.

Building on this distinction, chapter four looked at ways in which IARCs and PPPs with food security oriented goals can apply IPRs while still maintaining their public goods objectives. The creation and implementation of creative IP policies and partnership agreements was found to be key in maintaining this balance. IP strategies which can achieve this balance include the use of non-assert agreements and creative licenses which may for example segment markets according to price and technology use and may result in royalty free technologies for the benefit of the poor in developing countries. PPPs and public research institutions are already experimenting with some of these strategies although their full effect is yet to be seen.

The creative exercise of IPRs to balance competing interests is predicated on the parties' capacity in IP management and strategy. The chapter made the case for increased investment in IP capacity particularly in public research institutions like the CG Centres and especially when food security oriented partnerships are formed with the private sector.

Chapter four examined the CG system wide IP guidelines and related policy documents. These were found to be mostly influenced by the FAO International Treaty. The guiding principles and other IP related documents acknowledge the need for the CG Centres to form partnerships with the private sector; they were found to allow for the mitigation of the excludability effect introduced by the use of IPRs.

8.3 The *potential* role of IP in food security

Sen's focus on entitlements of individuals and households to food, i.e. their *access* to the food available, is perhaps the most vulnerable to the effect of IPRs on food security. Chapter three looked at the *potential* impacts of IPRs on food security. IPRs were found to have the potential to undermine food security efforts although their effect is found to be dependent on how the IPRs are exercised; this underscores the difference between the existence and exercise of IPRs.

PBRs could potentially raise the cost of protected seed as the breeder asserts his right to recoup his plant breeding expenses through the imposition of royalties. Where the seed protected relates to food crops, the farmers' limited access to the protected seed has a direct impact on his food security. Although sound in theory, this argument may be critiqued in three ways. Firstly, it is more probable that private plant breeding efforts are directed to commercial crops and that therefore subsistence farmers' access to seed is not affected – evidence from Kenya illustrates that PBRs have benefitted cash crops more than they have food crops. Secondly, in most developing countries - and certainly in Kenya and India - farmers' rights are protected (covertly in the former and overtly in the latter): farmers can reuse and exchange seed with other farmers. Thirdly, seed whose access is paramount to farmers and which is also of interest to the private sector e.g. cereals such as maize and rice is likely to be technology protected i.e. hybrid; farmers' access therefore is curtailed not by IPRs but by the science involved. While it is widely accepted that on-farm experimentation and conservation are important bedrocks for food security in developing countries, there is no empirical evidence suggesting that these are curtailed by IPRs. This may however be due to 'weak' implementation of IPRs especially in developing countries. Stakeholders must therefore remain vigilant on developments in IPRs and their likely impact on control over and access to plant genetic resources.

The current agricultural environment is characterised by increasing privatization of research. One concern about private sector influenced research is the possibility of distortion of research priorities. If this were to occur, orphan crops mostly relevant to subsistence farmers and of no interest to the private sector would be neglected. In this way, IPRs could be said to indirectly influence food security. One observation on PBRs in Kenya is that over four fifths of all PBR applications are for cash crops; the ensuing assumption would be that there would

be increased investment in the cash crops because of the appropriation potential and that this would undermine investment in food crops. This is however not always the case: firstly, the presence of an IP system does not imply its usage by breeders. Secondly, appropriation of benefits is often through non-IPR mechanisms such as hybridisation and thirdly, there is no evidence that the presence of a PBR system has led to a decline in public investment in food crops in Kenya and India.

Concerns have been raised over the DUS criteria used for PBR protection and its impact on genetic diversity of crops. Arguments are proffered that commercial plant varieties protected by PBRs will replace landraces and diverse seed varieties adapted by farmers for local conditions resulting in homogeneity of crops. These homogenous crops have been blamed for a decline in crops' resistance to pests and diseases. Databases maintained by farmers' groups in India on varieties developed and cultivated by farmers in addition to inclusion of traditional knowledge as a category of IPRs may help mitigate the potential effects of PBRs on food security in this regard.

One other potential effect of IP on food security relates to the restriction of protected technology for research. Although most jurisdictions allow for 'research use' exemption, research organisations nevertheless often have to negotiate Freedom to Operate (FTO) agreements with right holders. This increases the costs of research; public research organisations with limited financial resources such as those in developing countries would particularly be vulnerable to increases in research costs.

8.4 Domestic IP legislation and the conduct of agricultural research

Since the inception of IPRs on a global scale, scholars, economists, policy makers and various stakeholders have debated whether strengthened IPRs lead to an increase in innovation. The primary rationales for IPRs are to reward the inventor for his efforts, enable him to recover the costs of his research, and to act as an incentive encouraging further invention. There is ample evidence that IPRs reward inventors and enable them to recover the cost of their research. The jury is out, however, on whether IPRs encourage innovation. The problem is compounded by conflicting and often inconclusive empirical evidence from different countries. Nonetheless, it is apparent that countries at different levels of

development require different levels of IP protection to ensure continued domestic innovation.

At a lower level, chapter five sought to find out if and how national IP legislation in Kenya and India influences food security oriented PPPs within their jurisdictions. The chapter argued that the existence of international and national IP regimes are not nearly as important in the conduct of research in food security oriented PPPs as the parties' institutional policies and the partnership agreements adopted by the parties. It reinforced the case for investment in capacity in negotiating IP and contract drafting and execution.

In terms of increasing agricultural innovation, the chapter found no correlation between the volume of applications for agricultural biotechnology patents and PBRs on one hand and the inception of IPRs on the other. Indeed, there is a dearth of data relating to patents in agriculture in the two countries; moreover, it is difficult to establish the number of applications relating to agricultural biotechnology. In the case of PBRs, India is yet to grant any although it has received about a thousand applications since the implementation of the PBR Act in May 2007. In Kenya, over two thirds of PBR applications are for cash crops: mostly horticultural crops and ornamentals. Foreign applications make up 58% of all PVP applications in Kenya; these however are not indicative of increased innovation. Save for 1997 when there was a surge in applications when the PBR system was implemented, applications by foreign entities has been largely constant. Local applications peaked in 2001 but only as a result of a decision to protect extant varieties held by the public sector. As there is no data available on innovation before and after the inception of IPRs, evidence from Kenya and India does not shed any significant light on whether IPRs have promoted agricultural innovation.

With regard to the impact of IP law on the conduct of research in agricultural PPPs involving the CG Centres, the chapter found that domestic IP law seems to play only a minor role at best. Except for providing a framework for IP protection where this is sought by a PPP, domestic legislation does not seem to feature in the documents relevant to the conduct of research in the PPPs. For partnerships involving the CG Centres, the FAO International Treaty is the most relevant international agreement to the PPP's research operations. Capacity in IP management and in negotiation of partnership agreements is vital and is a prerequisite to a food security PPPs particularly those that are potentially proprietary.

8.5 The role of IP in the formation, negotiation and execution of agricultural PPPs

Chapters six reviewed the two case studies while chapter seven analysed them using the various themes laid out by the preceding chapters. Chapter six conducted a review of the studies on PPPs in the CGIAR. The private sector constitutes 4% of the CG Centres' key collaborators. The private sector's main presence is in the field of agricultural biotechnology and in plant breeding. These two fields are the focus of the ILRI ECF project and the ICRISAT-PS consortia respectively. The two case studies therefore represent the typical areas where private sector involvement in agriculture is most likely. The studies on PPPs in the CGIAR do not explicitly consider whether IPRs are a factor motivating collaboration; nothing in the findings suggests that IPRs have aided the formation of PPPs in agricultural research.

Various studies reveal that PPPs are a growing strategy in addressing issues in agricultural R&D. Efforts to characterise PPPs focus on the near-impossible task of capturing all facets of a PPP into a rigid category. The chapter advocated for bespoke analyses of PPPs as the preferred approach yielding qualitative results; chapters six and seven are examples of this analytical approach.

Chapter six consisted of an in-depth analysis of ICRISAT's and ILRI's IP policies and found these to be influenced by the CG system wide IP guidelines and by the FAO International Treaty. Both the institutions' IP policies attempt to address the tension between IPRs and the provision of public goods. Evidence from both Centres shows that it is possible to apply IPRs to the Centres' research products without compromising their global public goods mandate.

Regarding the partnership formation stage, the literature on PPPs does not seem to place IPRs high on the factors motivating parties from different sectors to collaborate with each other. Chapter seven looked at factors motivating parties in the study PPPs to form the respective partnerships; the ultimate objective was to locate IP among these factors. The chapter found that the two most influential motivating factors were complementary synergies and parties' comparative advantage in the relevant field. In so far as IP is a product of intellectual assets – which comprise *inter alia* information, knowledge, experience, technology and technical skills – IP can be said to be a factor motivating collaboration but only to this extent. More accurately, it is the potential to exploit or take advantage of a partner's intellectual assets that

is more important as a motivating factor to join a partnership; whether or not those intellectual assets are protected by IPRs is by and large immaterial as a motivating factor. It is the availability of intellectual assets rather than their protection that draws a party to another in partnership.

In the analysis of the two food security oriented PPPs, other issues related to IP become evident. One such issue is that of differing perspectives held by either sector on the concept of IP and its application within the context of the respective PPPs. It has been argued that IPRs are modelled on private gains and therefore more compatible with private sector research. The motive behind the application of IPRs by the IARCs is to secure inventions for the public domain.

Chapter seven looked at the role of IP at the partnership negotiation stage. The IP policy objectives of the two sectors are at odds. Although there is no definitive evidence that private sector investment in agricultural research crucially depends on the protection of IP, there are suggestions that appropriation of benefits (including through IPRs) is one of the factors influencing private sector investment in agriculture. The private sector's IP policy objective is to preserve the status of inventions as IP from which benefits, financial and otherwise, can be extracted. The CG's IP policy objective on the other hand is to mitigate the 'excludability' element introduced by IPRs so as to ensure that protected products are still available and accessible to the public, particularly poor farmers.

Underscoring the finding in chapter five that IP law *per se* has minimal impact on the implementation and execution of a PPP, the findings from the two case studies introduce the dimension that contract law is more important in the execution of a partnership and that capacity to negotiate fair IP terms as well as other contractual elements is crucial in balancing the different and often conflicting IP policy objectives. PPPs are premised on the presence of a common and mutual objective; studies on PPPs demonstrate that there is sufficient space for collaboration between the public and private sectors. By focusing on this space, collaborating parties are able to formulate minimum terms that are flexible enough to accommodate all parties.

Where IP interests are not sufficiently accommodated in the partnership agreement, consequences differ across partnerships and across parties. The ICRISAT-PS consortia

showed that some private seed companies opted not to join the consortia because of IP reasons while in the ILRI ECF project, Merial had IP considerations before joining the partnership, although these were not significant enough to deter its membership of the PPP. IP reasons also determined the design of the ICRISAT-PS consortia: a consortium approach based on grants from private seed companies was adopted rather than a contract research model as the latter was perceived as compromising ICRISAT's IP policy.

The primacy of the partnership agreement including the terms relating to IP makes a solid case for investment of sufficient capacity to negotiate contract terms in both sectors. Just as IP capacity is needed in the public sector to fashion IP policies in a manner that balances IPRs with the public sector's public goods mandate, capacity in IP management is likewise needed to ensure that IP clauses in partnership agreements are executed in a fair manner.

Findings from the ICRISAT-PS consortia challenge the commonly held belief that the private sector has ample capacity in IP and its management: a significant number of the local seed companies did not have IP policies; only a few considered them necessary and were in the process of formulating them; the MNCs however had IP policies and sufficient IP capacity.

Previous studies on PPPs in the CGIAR have suggested that IPRs are an important issue for consideration in the design and implementation of PPPs. The influence of IPRs on the design of PPPs was discussed in chapter seven in the ICRISAT-PS consortia. The PPP goes further to show that just as IP can affect a PPP's design, the latter may have IP implications: the consortia's design and the terms of the Letters of Agreement in effect offer exclusivity to some members for a limited period.

Findings from both case studies demonstrated the role of IP in the execution of the respective PPPs as subjugated by other factors. A previous study on PPPs in the CGIAR suggested that exchange of IP protected technology between the public and private sectors is not in and of itself a barrier to successful PPPs. The two case studies bear this out and go further to show that while IPRs may be important to a PPP, there are other factors more crucial to the success of a PPP. Both PPPs identified mutual trust as the most important factor; others such as communication, confidentiality and competency were ranked higher than IPRs. The private sector in the ECF project qualified the ranking by suggesting that although IP is not the most important factor in a PPP's success, it plays a significant role in determining the course of the

PPP - particularly if the nature of the research conducted involves products with proprietary potential.

8.6 Summary of findings

This thesis advocates for, among other things, a bespoke qualitative analysis of PPPs as the preferred method that ensures the influence of factors such as IPRs on food security oriented PPPs in the context of development are sufficiently captured and analysed. Given the nature of such qualitative research, the findings are not universal for all agricultural PPPs working in a development context or indeed for all PPPs involving CG Centres. The case studies however highlight various issues and themes that can be used in analysing other agricultural PPPs.

Chapter one presented the main **hypothesis** for this study: that **IP is relevant to food security oriented PPPs in developing countries and that it affects their formation and execution**. The thesis sought to answer whether, how and in what ways IP is relevant to food security PPPs in developing countries. The thesis finds that the **relevance of IP to food security oriented PPPs in developing countries is determined by two factors: the nature of the technology used in the partnership and the stage of the partnership**.
Summarised, other main findings of the thesis are:

1. IP and increasing privatisation of agricultural research
    - There is insufficient evidence to suggest that IPRs have helped increase private sector presence in agriculture in Kenya and India. However, there are indications that private sector presence may be responsible in part for the increasing use of IPRs in agricultural food security oriented research.
    - IARCs' exposure to IPRs can partly be attributed to the IARCs' interaction with the private sector.
2. IPRs and the provision of public goods
    - Theoretically, IPRs and the provision of public goods are at odds: IPRs make goods excludable while the underlying theory behind the provision of public goods is that these should be equally accessible to all. Theoretically, the use of IPRs by public

research institutions like the IARCs compromises the institutions' public goods mandate. This relates to the *existence* of IPRs.

- There is a distinction between the *existence* and the *exercise* of IPRs. It is the latter rather than the former that determines the delivery of protected public goods.

3. Mitigation of excludability
    - Through the creative exercise of IPRs, public research institutions like the CG Centres can mitigate the excludability effect introduced by IPRs thereby ensuring that their public goods mandate are not compromised. The CG system wide policies achieve this balance and acknowledge the need for the CG Centres to form partnerships with the private sector.
    - Sufficient IP capacity is prefatory to the creative exercise of IPRs. Public agricultural research institutions must invest in building IP capacity particularly where partnership with the private sector is foreseen or where the institution's research involves proprietary technology.
4. IP and food security
    - IPRs have the *potential* to influence food security in developing countries in various ways. These include limiting control over and access to PGRs by poor farmers; promoting private sector led research and the concomitant distortion of research priorities; promoting the homogeneity of plant varieties through the mandatory DUS criteria and the attendant loss of biodiversity and increasing the costs of public agricultural research by necessitating the negotiation of FTO agreements for protected technologies. This however relates to the *potential* impact of IPRs; it is how IPRs are *exercised* that ultimately determines the outcome of their application and the effects of this on food security.
5. Domestic IP law and the conduct of agricultural research
    - Domestic IP legislation in Kenya and India does not have any bearing on the execution of the two case studies but rather the IP policies of the respective institutions and the agreements governing the PPPs.
    - For Kenya and India, there is insufficient evidence that IPRs have promoted agricultural innovation. There is no correlation between the volume of applications for agricultural biotechnology patents and PBRs on the one hand and the inception of IPRs on the other.

- Of the five main international conventions and treaties relevant to IP in agriculture (the TRIPs Agreement, the CBD, the FAO International Treaty and the UPOV Conventions), the FAO International Treaty is the most relevant to the research conducted by CG Centres. Further, the Treaty is more relevant to the conduct of research in both case studies than Kenyan and Indian IP legislation.

6. Role of IP in the creation, negotiation and execution of the case studies

- The impact and influence of IPRs is unique to each PPP; only a qualitative analysis of a PPP can reveal the significance of IP to the individual partnership.
- It is the potential to exploit or take advantage of a prospective partner's *intellectual assets* rather than the assets' IP status that draws a party to another in partnership. Whether or not a prospective partner's intellectual assets are protected by IPRs is largely immaterial as a factor motivating collaboration except to the extent IPRs demonstrate the presence of intellectual assets.
- The public sector's perspective on the concept and application of IPRs in the PPPs differs from that of the private sector. This difference is reflected in the parties' respective IP policy objectives. The differing perspectives have the effect, *inter alia*, of raising the costs of IP management in the PPP. Creative and flexible partnership agreements can mitigate this potential conflict by finding and capitalising on the parties' common objective.
- IP negotiation and management capacity is vital to all parties; the two case studies reveal that although this capacity exists in the two CG Centres, there is room for improvement. The findings indicate that some private sector firms such as local seed companies are lacking in IP capacity.
- IP law *per se* has minimal impact on the implementation and execution of a PPP; contract law, in so far as it governs the partnership agreement, is more relevant to the execution of a PPP than IP legislation is.
- IP related issues can influence the design of a partnership; the PPP's design, in turn, can have IP implications by for example, offering exclusivity of the end products to some members as in the ICRISAT-PS consortia.
- IP has a role in the creation, negotiation and execution of food security oriented PPPs in developing countries. Its role is determined by the nature of research and by the stage of the partnership. These two determinants suggest that for food security oriented PPPs whose research is potentially proprietary, IP is mostly significant at the

negotiation and execution stages and less so at the creation stage while for PPPs with non-proprietary research products, IP is mostly significant at the formation stage and hardly plays a role in the negotiation and execution stages.

- While IP is relevant to food security oriented PPPs, both case studies show that there are other factors more crucial to a PPP's success. The most important of these is mutual trust. Others are research competence, communication and good will.

8.7 Suggestions and the way forward

There have been no conclusive studies conducted on the role of IPRs in agricultural innovation in developing countries; indeed, there is a dearth of information on the role of IPRs in domestic innovation generally. A comprehensive study focusing on this, especially in the development context, would be invaluable in developing national and institutional policies relevant to a country's level of agricultural R&D and reflective of an institute's capacity.

Various studies show that IP is increasingly in use in public institutions including IARCs yet capacity is generally lacking. These institutions need to develop IP policies and capacity especially where collaboration with the private sector is anticipated. This would ensure that their public goods mandate is not compromised and that the terms relating to ownership of IP are fair. Periodic intellectual asset audits in a public research institute would enable it to identify and evaluate its own proprietary assets thereby enhancing its awareness of the potential leverage that it can wield in negotiations with the private sector.

The need for IP management in public research organisations must however be weighed against the costs. For scholars, this is a minefield for further research on economic, legal, institutional and organisational mechanisms that ensure the costs of IP protection and administration in public research organisations - particularly those working in a development context - do not outweigh the benefits. Perhaps a manual or handbook of different practices could be developed to help IP practitioners and managers in public research organisations decide whether, when and how to seek IP protection for its technology, to use technology protected by third parties and to negotiate IP terms with the private sector in the context of agricultural PPPs in developing countries.

The analysis in this thesis is limited to two case studies. Further research on the role of IP on other PPPs in agricultural R&D is required. This would help address the unique role of IP in individual PPPs and perhaps aid in improving the understanding of IP's influence in various models of collaboration between the public and private sectors.

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